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CITY

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JANUARY, 1931

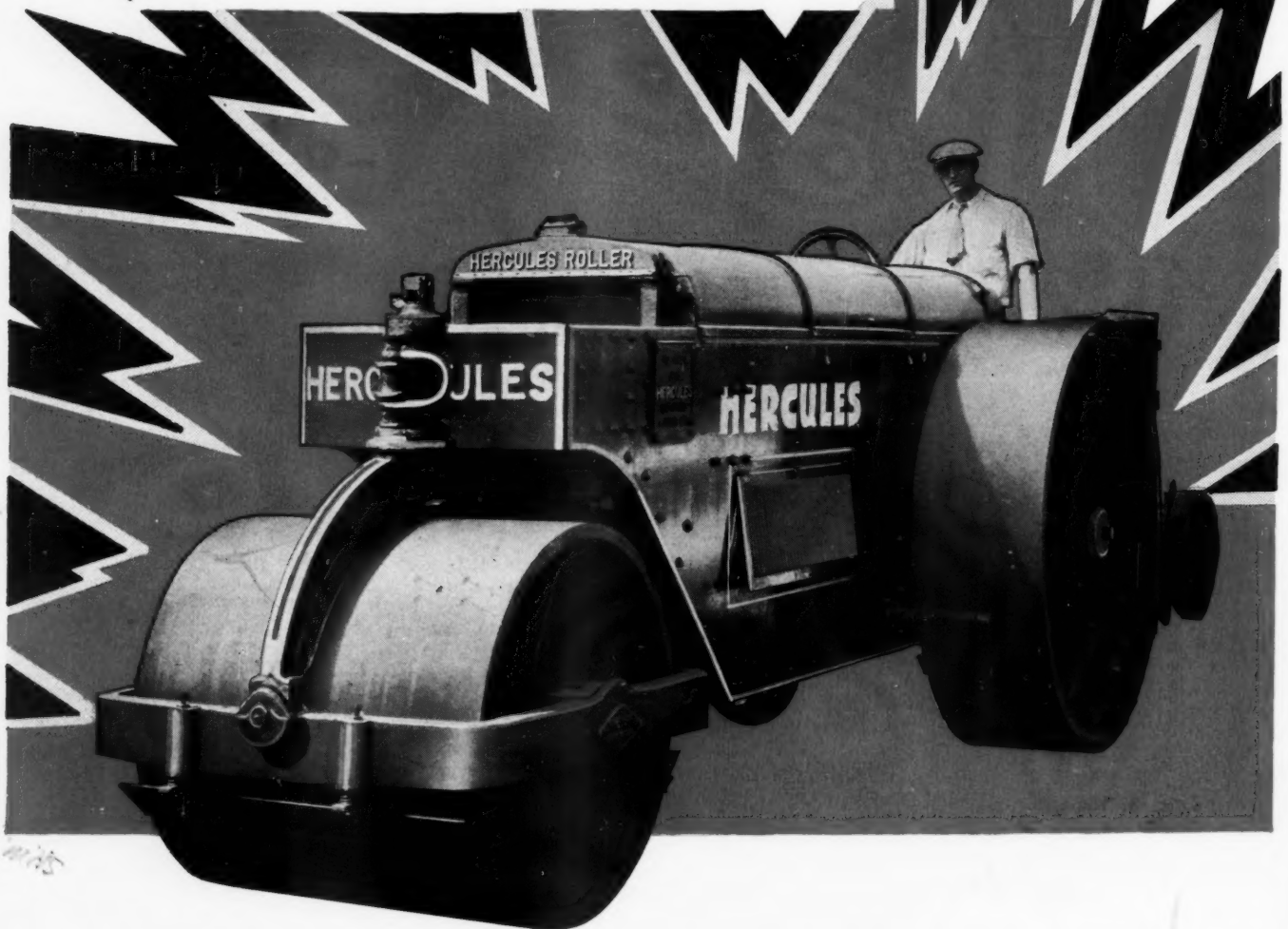
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PUBLIC WORKS

An Engineering and Construction Journal

City

County

State

VOL. 62

JANUARY, 1931

NO. 1

TABLE OF CONTENTS FOR JANUARY, 1931

Airports	
Contracting Units in Airport Construction.....	74
Book Reviews	8
Construction	
Grading Equipment and Overhaul.....	40
Trenching by Hand vs. Machinery in Topeka.....	58
Money Saving Methods	97
Editor's Page	35
Equipment	
Equipment at the Road Show.....	42
Equipment for Construction Economy.....	98
Engineering Societies	93
General	
Photo Recording of Documents a Great Saving.....	25
A County Smoke Department.....	54
English Humor in Advertising.....	88
Highways and Pavements	
A General Review of Paving During 1930. By C. D. Pollock.....	19
The Development of Sand Asphalt Roads. By B. E. Gray.....	22
Grading and Drainage on a Pennsylvania Highway. By C. R. Forbes.....	24
Low-Cost Residence Streets. By George E. Martin.....	28
An Australian Engineer's Impressions of American Highways. By C. V. Vaughan.....	31
Machine Finishing of Black Top Pavement Reduced Labor Costs.....	32
More Than a Mile of 20-Foot Pavement in a Week.....	36
Gas Tax for Township Roads in Minnesota. By N. C. Nickerson.....	38
Employment and Highway Expenditures in 1930.....	39
How a Sparsely Settled Virginia County Financed Road Building.....	39
Procedure in Purchase of Highway Equipment by States.....	40
San Francisco Boulevard Construction.....	54
Traffic Requirements for Traffic-Actuated Signals.....	76
Costs of Grade Crossings.....	91
Filling Expansion Joints With One Pouring.....	97
Industrial Literature	99
Legal Decisions for the Engineer and Contractor	68
Refuse Collection and Disposal	
Should a Community Retain a Consulting Engineer When Planning for Incineration? By A. E. Stilson.....	34
Garbage Disposal in Small Municipalities.....	88
Sewerage and Sewage Treatment	
Activated Sludge Plant Using Mechanical Aeration. By P. B. Streander.....	26
School for New York Sewage Plant Operators.....	61
A Cast Iron Sewer With Victaulic Joints.....	97
Snow Removal	
Snow Removal Equipment	92
Reducing Maintenance Costs on Snow Plow Equipment.....	97
Water Supply and Purification	
Monthly Digest of Water Works Literature. By Isador W. Mendelsohn.....	29
Nashville Filtration Plant	37
Training of Water and Sewage Plant Operators.....	57
With the Authors	4

Play Fair:

This paper—and especially *The Bookworm*—dis-sents most decidedly from a recent proposal by licensing boards to penalize non-college men. Those behind this idea would grant licenses as at present to men who are graduates of recognized technical schools. But the man who did not have the means to go to college, who has had to acquire his education by study at night and at odd times, who has had to make his own way—he will have to take an examination.

By all means have the examination if that will disclose whether or not a man is qualified to act as an engineer, but make it apply to all alike.

The prime essentials of a good engineer are *integrity, common sense and backbone*, and none of these is the monopoly of a college man. College education helps, but it is no place near an essential to being an engineer, in all that that word implies.

When you have read this, write "The Bookworm" in care of this magazine, and tell him just what you think. Pro or con.

Wanted—A Name:

In this issue begins a feature that all interested in water works design or operation should appreciate. We refer to the article beginning on page 29. The title used is only tentative. We have given some thought to, and received a number of suggestions for, a better and snappier heading. Some one, with leanings toward "alliteration's artful aid," has suggested *Water Works Winnowings*. However, the *Bookworm*, noting that loud bold-face type, is more inclined to suggest *Hydraulic Hollers*. The wife collaborated long enough to get into trouble by suggesting *Mendelssohn's Spring Song*.

However, this is a most valuable feature, and one worthy of a proper heading. Therefore, we'll be glad to pay \$5 to the one who sends in the most acceptable title for this feature. To get the money, you have to please the EDITOR. He is the judge. Send on your suggestion.

Exercising the Slide Rules:

With employment as it isn't and unemployment as it is, there must be a good many slide rules getting dusty from disuse. Here is a chance to exercise them a little: The equatorial circumference of the earth was measured and found to be 24,902.46 miles. If, in making the measurements, the tape had been supported on tripods 6 feet above the earth's surface, and assuming the surface at the equator to be perfectly smooth, what would have been the error (or excess measurement) due to using the tripods instead of measuring along the earth surface?

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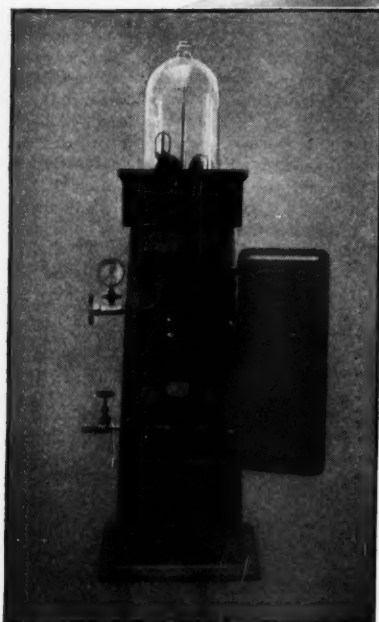
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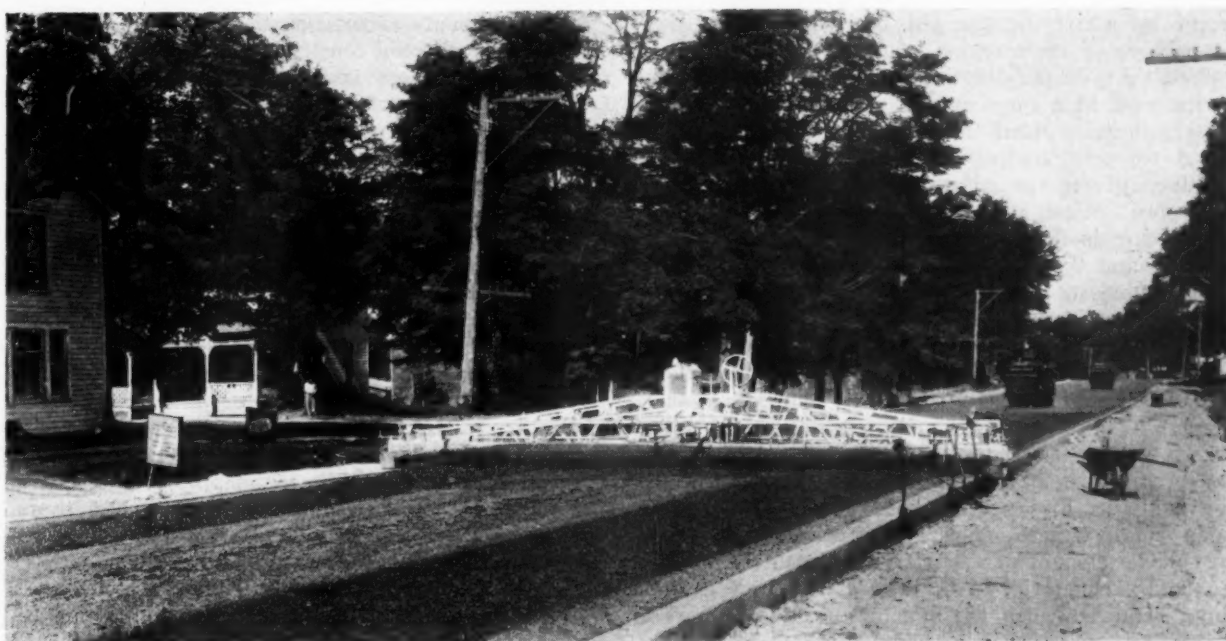
STATE

AN ENGINEERING AND CONSTRUCTION MONTHLY

Vol. 62

January, 1931

No. 1



Courtesy "The Low Bidder."
Spreading a cold asphalt mix (Type MM4) on a New York State highway with a finishing machine.

A General Review of Paving During the Year 1930

By Clarence D. Pollock*

THE year 1930 has been an active one in the highway field and most types of pavement show an increase in construction over that done in 1929. Assessment work in cities has decreased due to the business situation, but there has been a very substantial increase in state and county work paid for from bond issues and gasoline taxes. It is too early to obtain complete statements in detail for the year, but the preliminary reports, as far as obtainable, make a good showing for the year, and the indications are for a still greater increase in highway construction for 1931. The Federal authorities have allocated the Federal Aid funds to the states four months earlier than is usual and now, if the states will act promptly, an early start may be made in the spring on a great volume of highway construction.

Considering the several types of pavement, which

will be taken up in alphabetical order, it will be evident that considerable progress has been made during the year in other ways than in volume alone. The trend has been towards better quality of materials, better specifications, better inspection and greater standardization of types.

Asphalt Pavements

The increase above last year in the use of asphalt in various ways on highway construction has been more than 15 per cent. Considerable educational work has been done toward developing the cheaper types for getting the farmers out to the main highways which lead to their markets and shipping points. Much has been accomplished in designing and standardizing these low-cost highways, in combining emulsified, cut-back and asphalt oils with crushed stone, gravel and sand by the blade method and by the use of the disc harrow. In the case of plant-mixed material, the

*Consulting Engineer, New York City.

trend has been toward more carefully designed mixtures and extensive use of machine spreaders, strikers and finishers.

A great deal of constructive work has been done in adapting the method of improving the highways to local conditions, and along this line many mixed-in-place road surfaces have been constructed utilizing local materials such as gravel, crushed stone or sand, or mixtures of them.

In making mixed-in-place gravel and crushed stone roads in the western states the aggregate is obtained by scarifying the old base, by adding new material, or a combination of the two. Asphalt is applied by pressure distributors, about $\frac{1}{2}$ gallon per square yard at a time, and then disc harrowed after each application until the desired mix has been obtained, when further mixing is done with the blading machines, giving special attention to any lean or over rich spots. When it is necessary to maintain traffic, this mixing is done in windrows along each side of the road and then spread over the whole road width. When a uniform surface has been obtained it is either thrown open to traffic or rolled. The latter is especially desirable if a heavy asphalt, such as a cut-back asphalt or an emulsified asphalt, is used. The thickness of this surface after it has been compacted varies from $1\frac{1}{2}$ to 3 inches, usually averaging about 2 inches, but the tendency now is towards the maximum thickness of 3 inches as the average. The size of the aggregate in the case of both gravel and broken stone usually ranges from 1 inch maximum down to dust. The amount of asphalt varies with the percentage of fine material in the aggregate, more asphalt being required when the amount of fine material is large.

In the eastern states, the construction of mixed-in-place or retread roads has consisted largely of cleaning the surface of old gravel or macadam roads and priming it with a light oil, and then distributing the aggregate and mixing it in place as described above.

Sand-asphalt pavements have been laid quite extensively, especially in the east, with marked success. The better ones are laid in two courses on a shaped and rolled subgrade, between timber forms securely

held by stakes along each edge. These timbers are left in place after the pavement has been completed. The base course is usually three inches thick after compression, and consists of a mixture containing $7\frac{1}{2}$ to 8 per cent of asphalt and the balance sand, which is thoroughly rolled. Upon it is spread a two-inch top course containing 10 to $10\frac{1}{2}$ per cent of asphalt, 8 to 12 per cent of filler dust, and the rest sand; which also is thoroughly rolled. Both courses are of hot, plant-mixed material. This pavement has proven an economical one both to lay and to maintain.

Large amounts of road surfacing and also of city pavements have been constructed by means of various machine distributors and finishers. These insure a better surface, a saving in cost and greater speed of construction; as much as 700 square yards per hour of 18-foot roadway can be laid and finished. Both hot-mixed and cold-mixed pavements have been constructed satisfactorily and economically by these machines; in fact, they can be used with any material which can be worked by hand rakes.

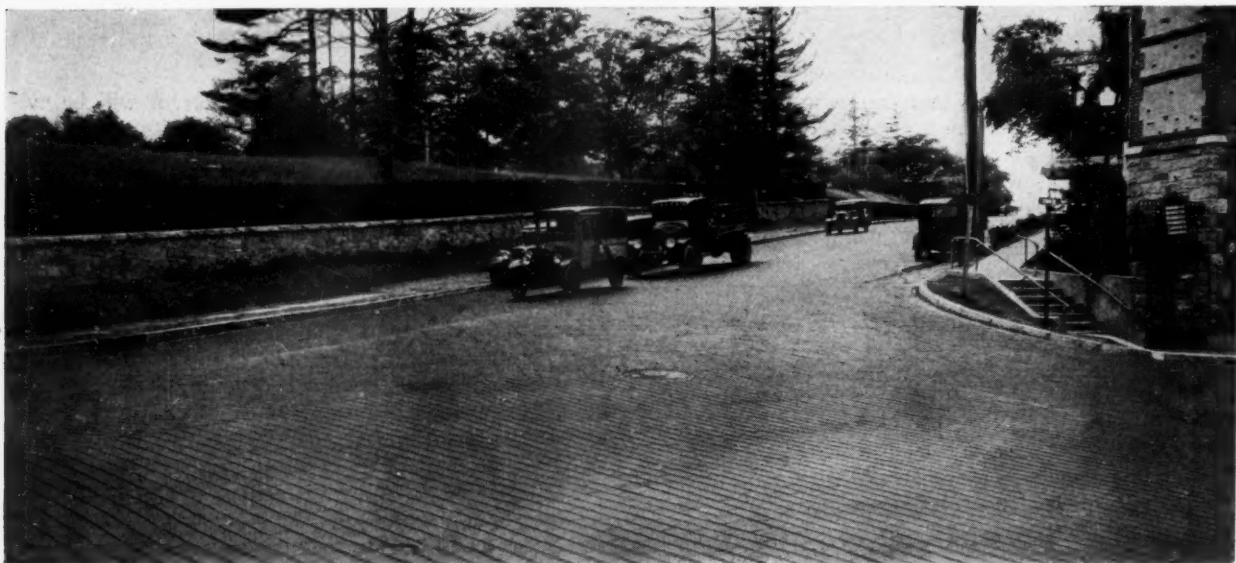
The standard sheet asphalt pavement on a concrete base has continued to be a very popular pavement for city streets, and also on highways where the traffic calls for heavy construction.

The use of the heater method of resurfacing old asphalt pavements has increased considerably. This method is especially adapted for use on old asphalt pavements which have a good depth of material but are in bad surface from many trench openings and the like. A large area can be covered quickly without much interference with traffic.

Asphalt Block Pavements

There has been an increasing use of this pavement during the year, especially with the "non-skid" type of construction on grades and curves, and also the use of asphalt blocks on bridges and viaducts.

The non-skid construction consists of laying the blocks with $\frac{1}{2}$ -inch strips of wood between the courses, then removing the strips and flushing in a cement grout. Before the grout gets a hard set, the top portion for a depth of about $\frac{1}{2}$ inch is raked out, leaving a recess about $\frac{1}{2}$ inch in width and of about the same depth between courses. This form of construction has



Non-skid asphalt block construction on the Albany Post Road at Dobbs Ferry, N. Y.

been used with success on grades and curves, eliminating accidents due to skidding. A notable instance is on part of the Albany Post Road in the village of Dobbs Ferry, N. Y.

A large industrial use of asphalt blocks has developed in the asphalt block industry, especially for factory and shop floors, pier pavements, warehouse floors and the like.

Brick Pavements

Brick pavements have continued to increase in the sections where they have proven to be economical and popular, especially in localities convenient to the point of manufacture.

The 3-inch depth brick seems to be that most generally used, although large quantities of the 2½-inch depth brick are being used, especially in the south and southwest. The commonly used filler is one of asphalt having a penetration of 50 to 60 at 77 degrees Fahrenheit; although during the year there has been an increasing use of asphalt fillers containing mineral matter, such as slate dust, fine sand etc. The latter enter the joints readily where the lug bricks are used, and also with bricks without lugs when they are paved with a slightly open joint. This joint filler is much more stable than the straight asphalt filler and eliminates bleeding in hot weather. New Orleans has had remarkable success with an asphalt mastic filler containing about 25 per cent by volume of fine, hot sand. With this filler there has been no trouble from bleeding, even in the warm climate of New Orleans.

Although most lines of construction have shown a loss during 1930, highway work has made a substantial increase of as much as 15 per cent in many lines, due in large measure to the activity in state and county highway construction, which seems to have more than offset the loss in municipal paving; the latter being due largely to the fact that much city paving is paid for by assessment.

This shows a proper trend, as money for highway work can be obtained at low interest, and good labor is abundant. Increased mileage of construction will help not only the unemployed but also the whole country by providing good highways at a low cost. And indirectly it will help the automobile industry, which provides work for a considerable portion of our people.

In September an experiment was tried on a road near Springfield, Ill., where iron plates were used as a foundation on 150 feet of the roadway. The subgrade was shaped and rolled, after which the plates were placed on the grade, three different types being used. One type was a series of flat plates ¼ inch thick, with the outer edge turned up as a header for the brick and one transverse edge turned down to grip in the earth, the other transverse edge and the center edge rested on the adjacent plates. On the other two 50-foot sections of the road, 10-gage corrugated galvanized iron sheets were used, one section

having the corrugations lengthwise and the other crosswise of the road, the former having T-bars under the transverse joints and the latter having an L welded to the outer edge to act as a curb for the brick on account of the difficulty of bending up the plate transversely of the corrugations. On these plates the brick were laid on an asphalt mastic cushion, using 2½ and 3-inch depth bricks the joints being filled with asphalt. It will be interesting to watch this experiment as to its cost and degree of success.

Concrete Pavements

The estimated total square yards of concrete pavement awards in the United States for the year 1930 is 145,000,000. This is an increase of about 3½ per cent over 1929. The outstanding changes in construction and specifications during the year are:

Greater attention has been given to the quality and sources of supply of concrete aggregates, which has
(Continued on page 61)



Stone block paving on West Side Highway, New York City. Insert: Excellent surface as shown by twelve-foot straight-edge.



Surfacing twelve feet wide on a town-
ship road



Across the sand dunes at the tip of
Cape Cod



Surfacing twenty-four feet wide on
Route 6

Sand-Asphalt Roads in Massachusetts

The Development of Sand-Asphalt Roads

History of the evolution of this variation of asphaltic concrete in Massachusetts and the present method of construction

By B. E. Gray

Highway Engineer, Asphalt Institute

NOTWITHSTANDING the expenditure of billions of dollars that has been made for highway construction, there remains a large mileage of unimproved roads for which provision will have to be made before we can truthfully say that the highway problem has been met. It is being impressed upon engineers more and more, and the public generally recognizes the situation (although they are rather inarticulate in expressing their views), that somehow or in some way methods must be found of providing more construction for the same money. One solution is in the more intelligent use of local materials, which largely eliminates the item of freight and hauling charges which makes up so large a percentage of construction costs with any fixed type. This involves a thorough study of local conditions, local geology, probable intensity of traffic and possible dispersion of traffic as additional mileage is added to the system.

In Massachusetts intelligent research of this kind has been carried on for many years. One result of this is the development of the sand-asphalt roads (a variety of asphaltic concrete) to meet the conditions found on Cape Cod—a type of road which might well be adopted in large areas of other states where similar conditions and materials are found.

The first sand and oil road was built in the town of Eastham about 1905, where the natural soil is sandy loam with a rather wide variation in grading. The original method of construction consisted of shaping the road with a road grader and applying oil from a home-made gravity distributor to a width of about sixteen feet. This oil (85 per cent asphaltic) was mixed with the sand, using a wheel harrow, until finally an oil-sand mixture was obtained, using approximately one and one-half gallons per square yard with a resulting depth of mat of approximately $2\frac{1}{2}$ inches. With this method of construction a fair surface was obtained, quite adequate for the traffic of

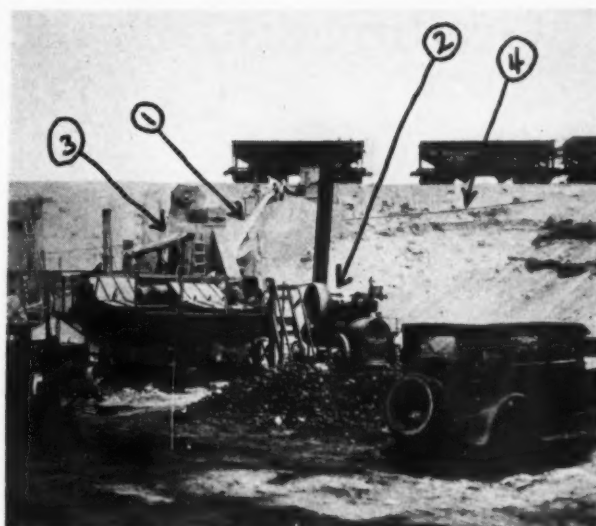
that day. The main fault was a slight unevenness, due to the settlement of the subgrade. This is now prevented by hardening the subgrade through the addition of a small amount of loam and clay, and then thorough compacting by rolling.

In 1909 the first premixed type was constructed, using asphalt of from 90 to 100 penetration (which made up about five per cent of the mass by weight). The sand was obtained locally from nearby sand banks, and in some instances contained gravel up to 2" maximum size. The hot mix was placed on a prepared subgrade to a depth of 4" loose, and then thoroughly rolled. This method was used until 1914. Little attention was paid to the grading of the aggregate, practically the only precaution being to reject particles over 2" diameter. On Route 6 in the town of Sandwich, a surface of this type, built in 1913, is still in use and has required maintenance of but two surface treatments of one-quarter gallon each, using 85 per cent asphaltic oil covered with clean, sharp sand. Thus, in spite of the fact that this was a hand-mixed job, it has had a useful life of seventeen years with practically no maintenance and under traffic up to as high as 8,000 daily. Roads built at this time were of high crown, and accordingly many of them have been resurfaced with the present-day machine-mix in order to obtain surfaces of modern design, adequate for present-day traffic. One of the advantages of the type lies in this very feature—that of easy reconstruction and widening as conditions make necessary. One trouble with the hand-mixed type, using the bank-run sand, was found in the non-uniformity of the finished product. The results, however, were so good and the cost of maintenance so low, that the state department felt certain it had found a type of construction, employing local materials, which was cheaper and better than other types using imported ones.

From 1914 until 1922, plant-mix sand-asphalt con-

struction was employed, using the small type of portable mixer and drier. Still very little attention was given to selecting properly graded sands except for occasional experiments in adding filler to obtain higher stability. Furthermore, the method of construction was to place the entire course in one layer (approximately 6" loose) and then to obtain final compaction by a thorough rolling. Many miles of old waterbound macadam were widened using this type of sand asphalt mix and feathering in from the widened section to take out the high crown. As the years went by, occasional surface treatments were applied until it was difficult to tell where the macadam left off and the sand-asphalt began, thus again proving its worth as a reconstruction material, and blending the two types of pavement together as traffic increased, so that no separation could be found between the two.

Beginning in 1921, it was decided to carry on a series of experiments to further improve the smoothness and stability of surface, in view of the increasing demands of traffic and the greater speed of motor vehicles, for the Cape Cod section had been increasing in its summer population until traffic densities approached those found adjacent to large cities. As a result of these experiments the present type of construction, which has been carried on for the past eight years, is of very high order, and makes the best use of the local material. The present specifications call for mineral aggregate of the following grading:



View of Sand-Asphalt plant

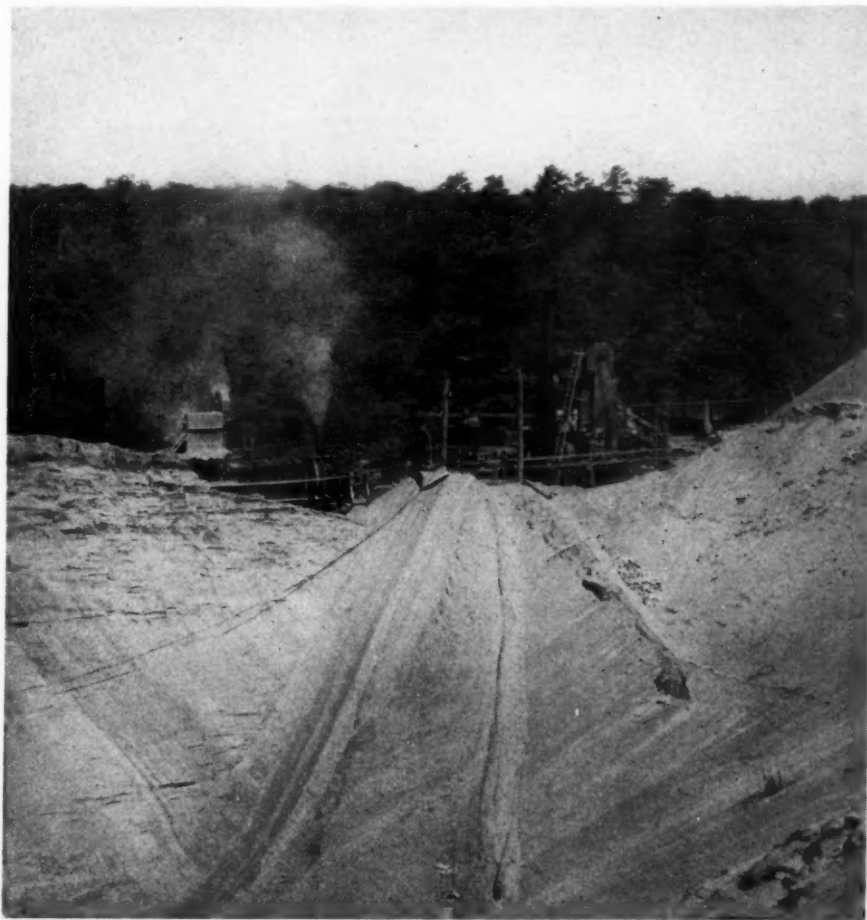
- 1—Unloading trap rock screenings.
2—Dragline brings sand to be mixed with screenings.
3—Hot mix plant.
4—Pipe line bringing asphalt to plant from tank car on siding.

Passing $\frac{3}{4}$ " screen	100%
Passing $\frac{3}{4}$ " screen, retained on $\frac{1}{4}$ " screen....	1%—17%
Passing $\frac{1}{4}$ " screen, retained on No. 10 sieve..	6%—26%
Passing No. 10 sieve, retained on No. 30 sieve..	20%—68%
Passing No. 30 sieve, retained on No. 100 sieve..	7%—45%
Passing 100 sieve	0%—15%

It can be readily seen that such a grading still permits the use of a fairly wide range of materials, and in a number of instances local sand banks furnish suitable grading without any further additions. In other cases, it has been found desirable to import a small amount of filler. This is usually trap rock screenings, which are cheaply available and give satisfactory results. The bituminous material consists of asphalt of 60 to 70 penetration, which makes up from $5\frac{1}{2}$ to $6\frac{1}{2}$ per cent of the mass by weight.

With the present construction methods, the surfacing is generally laid directly upon the natural prepared subgrade. In some instances, where it is either too sandy or too loamy, clay or sand is added and mixed to harden the subgrade, after which it is thoroughly compacted with a ten-ton roller and straight-edged so as not have a variation of over $\frac{1}{4}$ " in ten feet. The sand-asphalt mix is prepared in approved machines until all particles of sand and stone are thoroughly covered with asphalt. Prior to mixing, the sand and stone screenings

(Continued on page 87)



Hauling sand from pit to mixing plant (in background) for constructing sand-asphalt roads on Cape Cod

Depth of pit gives good idea of amount of construction handled from this one site.

Grading and Drainage on a Pennsylvania Highway

By C. R. Forbes

Division Engineer, Pennsylvania Dept. of Highways

ON February 8th, 1930, the Pennsylvania Department of Highways let a contract to R. H. Cunningham & Sons, of Turtle Creek, (the lowest bidder) for the reconstruction of a section of Route 55 in Huntingdon County, known as the William Penn Highway, one mile east of Alexandria and two miles west of Huntingdon.

The contract called for grading and drainage of 4.74 miles of a roadbed 36 feet wide, upon which was to be placed a one-course reinforced concrete pavement 20 feet wide and 9-7-9 inches thick.

The grading involved handling 288,000 cubic yards of excavation, of which 65 per cent could be classified as solid rock and the balance as shale and earth.

The principal drainage feature was a 24-foot span arch culvert 40 feet long, and five others of from 4 to 6 feet span and 89 to 212 feet long.

Work on the smaller arches was started March 31. On April 21 fifteen cars of equipment for the contract were unloaded at Huntingdon.

On the 25th of April, five power shovels started work along the eastern slope of what is known as Warriors Ridge. On May 1, two additional shovels were received and placed in the heavy excavation at the top of this ridge. The excavation on this section consisted of sandstone and Ganister ledges which required well drills to be placed ahead of the shovels. The blasting was handled by experts and little delay was caused in the operation of the shovels. As the excavation proceeded westward, solid limestone rock was encountered and portable compressed air drills were used. These compressed-air drills averaged about 50 feet per hour through this limestone rock.

The contractor had by this time perfected his or-

At right: Excavation through the cut at Charley's Hill and construction of the 24-foot span arch



At left: Part of the equipment used in making the cuts—shovel, roller, bulldozer and trucks

ganization, and by placing from two to four shovels in tandem, or on ledges one above the other, in the same cut from 30 to 50 feet apart, was able to move 48,000 cubic yards of excavation by the middle of May. Also, by this time two of the smaller arch bridges had been completed.

An additional two-cubic-yard power shovel was placed on the work on June 1, and averaged through the limestone rock 700 cubic yards per day, and by June 15 a total of 120,000 cubic yards had been excavated and placed in the embankments. Also four of the smaller arch culverts (respectively 101, 86, 196, and 194 feet in length) had been completed by this date.

The excavation was hauled from these shovels to the embankments in a steady stream by the use of trailer wagons, trucks, and Linn tractor trucks, and at times three power rollers were used in the compaction of the material in a single embankment. These embankments were brought up in layers varying from 4 inches to 2 feet in depth, depending whether or not the material to be placed in the embankment was of solid rock, or a mixture of rock and earth, or all earth. The material, after being dumped, was spread over the area of the embankment by tractor bulldozers.

By the 15th of July, 190,000 cubic yards of material had been excavated and the fifth arch culvert, having a span of 6 feet and a length of 212 feet, had been completed.

At a point known as Charley Hill, near the west end of the project, very heavy excavation was required and also the widening of the Juniata river from 60 to 70 feet north was required. The excavation in this cut, covering a length of 450 feet, required the removal of 30,000 cubic yards consisting mostly of solid limestone rock. Traffic was accommodated at all times on the old road at the top of the slope of this cut. The largest single cut encountered was located near the center of the project, in which 38,000 cubic yards were excavated within a distance of 570 feet.

The daily average excavation moved and placed in the embankments from the beginning to the end of the grading operation approximated 3,000 cubic yards.

Five months after the grading operation had been started on this project, all of the grading and draining had been completed and preparations were under way to start the concrete paving operation. By October 1st all of the concrete pavement had been laid, and the road was opened to traffic on October 11.

The equipment used for the grading on this project was as follows:

- 1—2-cubic yard capacity power shovel
- 2—1 $\frac{1}{4}$ -cubic yard capacity power shovels
- 2—1-cubic yard capacity power shovels

- 3— $\frac{3}{4}$ -cubic yard capacity power shovels
- 9—tractor trucks
- 4—7-cubic yard wagons
- 1—10-cubic yard wagon
- 3—60 caterpillar tractors
- 1—75 Monarch tractor
- 10—motor trucks
- 3—tractor bulldozers
- 5—10-ton power rollers
- 1—well drill
- 1—portable compressed air drill

Practically all of this construction was on relocation which crossed and recrossed the existing highway, but traffic was maintained at all times over the old highway and at no time was seriously inconvenienced.

Under the distribution of working days that had been provided for the completion of the entire contract, 107 days had been allotted for the organizing and the assembling of the grading equipment, and completion of the grading and drainage, and the actual time that it took the contractor to complete all of his grading and drainage was 107 days, so that he was exactly on the time scheduled.

Claim Photo Recording of Documents a Great Saving

Recording of public documents in the Los Angeles county recorder's office by a system of photography would save Los Angeles county not less than \$175,000 a year, according to a survey of the recorder's office made by the county bureau of efficiency.

The survey, filed by Sam J. Chappel, secretary of the board, recommends that the state legislature pass a bill permitting any county desiring to do so to install photographic recording, and permitting the adoption of this system by Los Angeles county.

The new system would correct the present plan of allowing title companies to handle instruments in the department—a system which creates a monopoly in the first use of recorded documents.



Excavation at Charley's Hill and changing the course of the Juniata river. Traffic was maintained on the old highway at the top of the slope

Activated Sludge Plant Using Mechanical Aeration

Preliminary settling, a new type of mechanical aerator, and separate sludge digestion constitute features of Collingswood, New Jersey, treatment plant.

By W. De Witt Vosburg and Phillip B. Streander

AN activated sludge treatment plant using mechanical agitation for the aeration of sewage was completed in July, 1930, for the borough of Collingswood, New Jersey, a typical suburban residential borough having a present population of about 13,000. The sewage is strictly domestic, has a suspended solids content of 225 p.p.m., a B.O.D. of 180 p.p.m. and contains no industrial wastes. The sewer system consists of about 30 miles of sewer, with several boosting stations in addition to the main pumping station at the treatment plant. Activated sludge treatment was decided upon after careful comparison with other methods of treatment. One important factor influencing this decision was the location of the plant. Dwellings are constructed to within 100 feet of the site, so that any plant constructed must of necessity be comparatively free from local and migratory odors.

Before deciding upon the method of aeration, careful consideration was given to both compressed air and mechanical aeration. Comparison was made from the standpoint of first cost, operating cost and maintenance. For this particular plant the comparison so obviously favored mechanical aeration that this method was adopted. The type of aerator finally decided upon was that manufactured by the Link Belt Co. which produces the spiral form of circulation and differs in practically no way from the "spiral flow process" as developed by Mr. Hurd at Indianapolis, except that purely mechanical means are used instead of diffused air.

Description of Plant

The plant was designed for a capacity of 2,000,000 gallons per day, on the basis of 20,000 population with an average daily sewage flow of 100 gallons per capita, including infiltration. Sewage is pumped into preliminary settling tanks, where the coarser sus-

pended solids are removed. It then flows through an aeration tank where the partly clarified sewage is agitated in the presence of sludge which has previously been activated. From this it flows into a final settling tank, wherein the mixture of sludge is separated from the sewage, the effluent of which is discharged into a contact tank where chlorine is applied for sterilization. Sludge from the preliminary settling tank and excess activated sludge are disposed of by digestion in an enclosed heated tank and the digested sludge dried under glass-covered sludge drying beds.

The units used in designing the various parts of the plant are as follows:

Preliminary settling tank—Detention period 1 hour.

Aeration tank—Detention period 6 hours, with 25% returned sludge.

Final settling tank—Detention period 1½ hours, with 25% returned sludge.

Contact tank—Detention period 30 minutes.

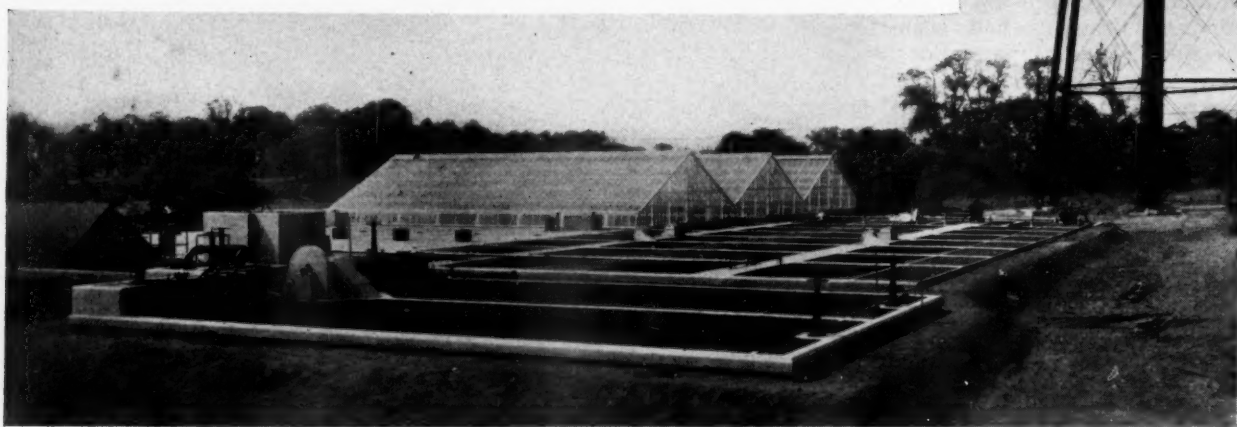
Sludge digestion tank—Volume 2.2 cu. ft. per capita, with heating of the sludge.

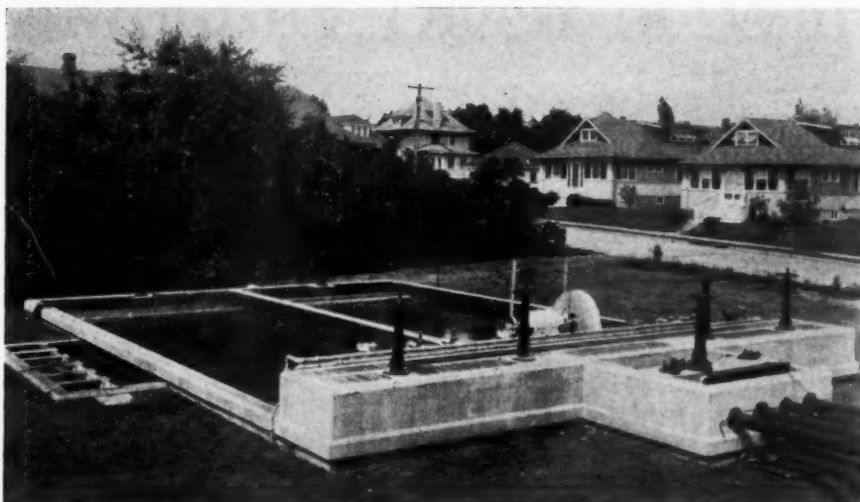
Sludge drying bed—Area 0.50 sq. ft. per capita, glass covered.

As actually built, the preliminary settling tank was constructed on the basis of 2,000,000 gallons per day

General View of Collingswood Sewage Treatment Plant

Primary settling tank in foreground. Aeration tanks at right rear of this. Sludge digestion tank left of aeration tank. Glass-covered sludge drying beds in the rear.





Primary settling tanks. Detritus hopper and weir chamber at left. Four force mains from sewage pumps and sewage diversion chamber at right foreground

capacity; but only two-thirds of the aeration tank and final settling was built, providing a capacity of 1,333,000 gallons per day. All other units were constructed on the basis previously stated. The actual average daily flow of sewage now reaching the treatment plant is 1,250,000 gallons per day, so that the aeration tank is practically working at full capacity.

Preliminary Settling Tanks

Sewage reaching the plant is pumped into the preliminary settling tank by horizontal engine driven centrifugal pumps. This tank is divided into two separate compartments, each 14.5 feet wide and 45 feet long, with an average sewage depth of 8.5 feet. Sludge is removed by means of mechanically operated scrapers, operated by a 2 h. p. motor, concentrating it in hoppers from which it is piped to the sludge digestion tank. Scum is removed by the scraper return

and discharged into scum troughs. The effluent from the tank discharges into a balancing chamber located alongside of the presettling tank, which distributes or balances the flow to the aeration tank compartments by spilling over "V" weirs into boxes from which it is piped to the respective compartments of the aerating tank.

Aeration Tank

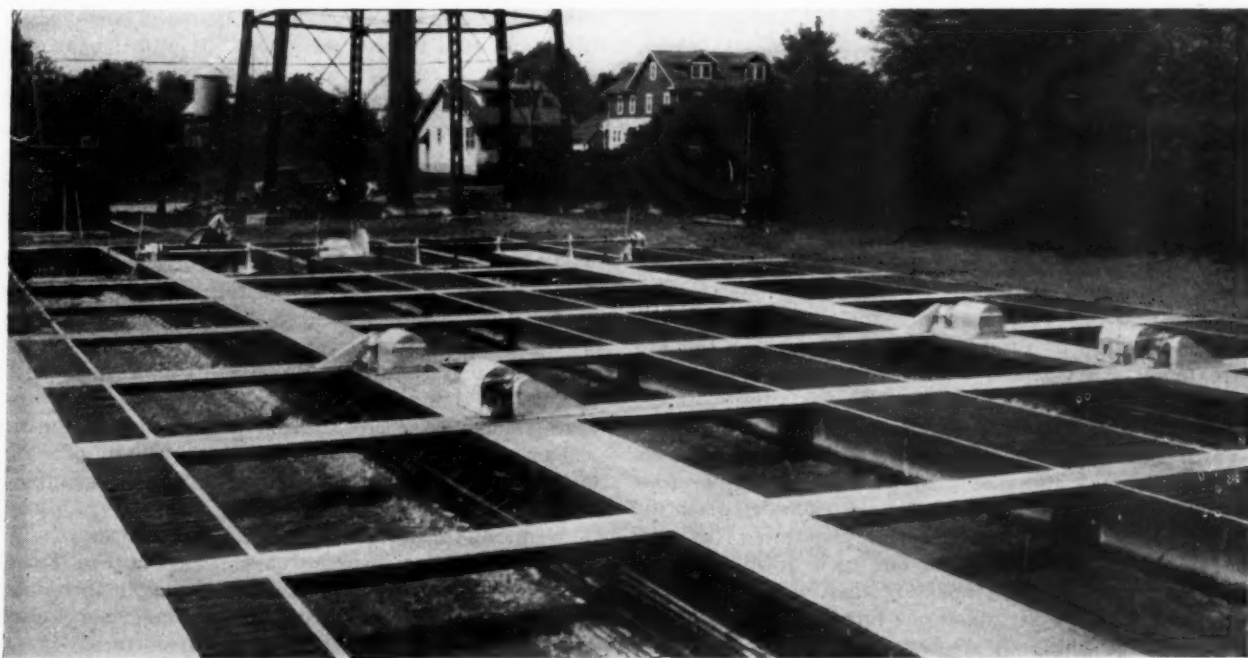
The aeration tank is divided into four separate compartments, each 125 feet long, 14.5 feet wide, with a sewage depth of 8.5 feet. Each compartment is provided with deflectors at each turn to reduce frictional losses and effect

easy changes in direction of flow.

Agitation and circulation are produced by the action of a revolving, paddle-like element of small diameter, located at one side and extending the whole length of a tank. The blades of the paddle are in the form of comparatively narrow ribbons, pitched on the shaft. The center of the shaft that carries the paddle blades is located a few inches above the surface of the liquid and approximately 3 feet from the side of the tank. The outside diameter of the cylindrical surface formed by the paddle blades when they revolve is about 26 inches.

To prevent short-circuiting of liquid in circulation, a vertical baffle wall is placed parallel to and at a distance of 18 inches from the wall of the tank, extending from a point a few inches above the surface of the

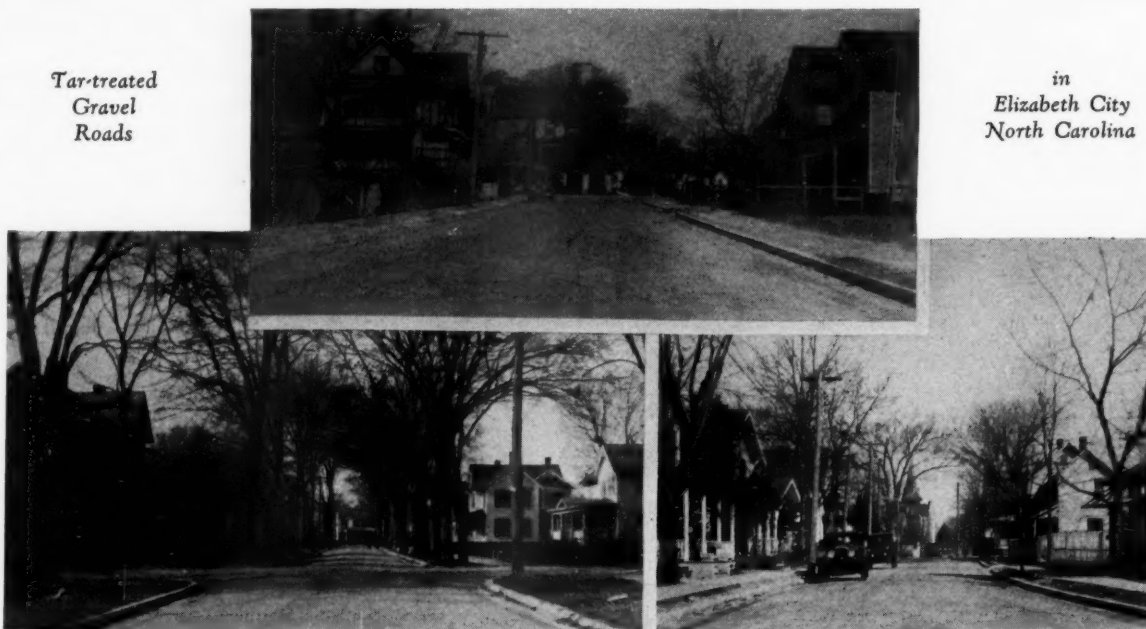
(Continued on page 62)



View of aeration tanks, showing the mechanical aerator along the side of the tank. Final settling tank and chlorine house in the background

Tar-treated
Gravel
Roads

in
Elizabeth City
North Carolina



Low-Cost Residence Streets

Beginning a Series Detailing the Practical Application of Low Cost Processes to City Streets and Rural Highways

By Geo. E. Martin

Consulting Engineer, General Tarvia Dept., The Barrett Co.

THE practical application of the low-cost road theory to specific examples in city streets has been an outstanding development of the past few years. One city which has taken advantage of these new methods is Elizabeth City, North Carolina.

Elizabeth City has a population of about twelve thousand and is a typical busy city of the modern south. Many of the residence streets have roadways built of James River gravel, which was placed to a compacted depth of six inches, the cost averaging about seventy cents per square yard.

In 1927, the city began improving these streets by tar surface treatments, changing them from loose, dusty gravel surfaces to smooth, tight, dustless ones at a very low cost.

The first operation was to shape up the top with a blade grader, to produce a smooth surface for the treatment. Tarvia-B, a cold refined tar with a specific viscosity of from eight to thirteen, was applied at the rate of approximately one-third gallon per square yard. This prime coat was not covered and was permitted to soak into the road surface for twenty-four hours, during which time traffic was excluded from the street. The prime coat material penetrated into the gravel for from one-half to one inch down from the top and bound the particles together.

The following day about one-third gallon per square yard of hot Tarvia-A was applied. This material has a float test at thirty-two degrees Centigrade of from 60 to 150 seconds and must be heated to between 200°

and 250° F. for application. This tar seal coat was covered immediately with about 45 pounds of blue limestone chips ranging in size from $\frac{1}{4}$ " to $\frac{3}{4}$ ". The stone chips were broomed out smooth and in some instances consolidated by traffic. In other instances a roller was used to set the stone chips into the tar seal coat.

The following year (1928) the original work was given a seal coat of from $\frac{1}{4}$ to $\frac{1}{3}$ gallon of hot Tarvia-A per square yard. This application was immediately covered with 20 to 25 pounds of $\frac{3}{8}$ " to $\frac{5}{8}$ " stone chips per square yard. No additional surface treatments have been necessary.

The cost of the first two applications of Tarvia and stone averaged about twenty-five cents per square yard. The seal the second year cost about nine cents per square yard; making a total cost of about thirty-four cents per square yard for the complete job. It will be noted that the additional seal coat the second year is considered an essential part of the treatment.

The stone cover for this work cost \$3.20 per ton, which increased the cost of the work somewhat above the average for similar projects.

About one hundred thousand square yards of surface treatment over gravel has been done in Elizabeth City. By the use of this low-cost method the city has been able to give satisfactory traffic service on residence streets for a very small expenditure.

Many other municipalities in North Carolina have
(Continued on page 67)

Monthly Digest of Water Works Literature

By Isador W. Mendelsohn, C. E.

DESIGN. In designing waterworks for cities of arid and semi-arid regions,⁹ consideration must be given to the extensive use of water for irrigation and the long periods of dry weather and high temperature during which the water consumption is maintained at a high level. The maximum demand on the distribution system usually occurs in the higher class residential section, rather than in the business or industrial sections. These conclusions are derived from water consumption, temperature and rainfall data of cities with different climates, such as Evansville, Indiana; Phoenix and Tucson, Arizona; Wichita Falls, Texas, and St. Louis, Missouri.

In general long, narrow and shallow sedimentation basins¹⁷ are likely to prove most efficient for coagulated water. Utilizing the 3½ mile long pipe line as agitation chamber and the 8,700 feet long tunnel of the Marin Municipal Water District of California as a sedimentation basin for reservoir water treated with alum at a 2 gr. p. g. dosage, the 30 p.p.m. apparent color and 10 p.p.m. turbidity of the raw water were reduced to 5 and 1.0 p.p.m. respectively.

Special hydraulic problems were involved in providing water under a 100 foot head for a large memorial fountain⁸ at Chicago. Two displays of 13,000 and 5,000 g.p.m. through 133 jets were supplied by three centrifugal pumps.

From the presentation of the general theory of a buttressed dam²⁰ of definitely known and uniform strength and a detailed discussion of its dimensional and quantity laws, the following conclusions are drawn: (1) The arched column principle presents a simple and exact means for designing buttressed dams of uniform strength; (2) this type of dam contains the minimum possible amount of material that can be obtained with a given design stress; and (3) it is superior in safety and economy to the gravity type for any height to which a concrete dam can be built.

In designing the filter and gallery equipment,²² standard equipment should be used for economical arrangement, and consideration should be given to efficiency, appearance, future extension, ease of erection, accessibility to all parts, ventilation, light and heat.

The greater precipitation about 4 a. m. and 4 p. m. is explained by the electron theory of rainfall,²⁵ to which is ascribed the concurrence of the twelve-hour cycle of barometric changes with the twelve-hour cycle in the electrical potential gradient in the lower air.

CONSTRUCTION. In the erection of a hydroelectric plant at Chute à Caron on the Saguenay River in Canada, a heavy concrete dam was built on dry land⁷ as part of the project for divert-

Mr. Mendelsohn has been asked by the editor to prepare this service as a regular monthly feature. As the product of a man thoroughly versed and widely experienced in this field, we believe that it will help you in your work, saving time and keeping you in touch with progress in water works matters. The editor would be glad to receive suggestions from our subscribers about this new feature.

ing the swift stream during construction and was dumped into place by a powder explosion. The scheme involved: (1) a fixed pier, relatively massive, to carry the greater part of the weight and thrust; (2) a small pier carrying part of the weight, to be blasted away; and (3) a cylindrical rolling face on the fixed pier, so designed and placed at such a location and elevation that the present dam would fall into an accurately predetermined position. The dam was 92 ft. high, 45 ft. thick up and down stream,

and had a maximum depth of 42 ft. It weighed 10,900 tons, and was built in Nov. and Dec., 1929. The face toward the channel was contoured to fit the river bottom. After the fall of the dam, which occurred on July 23, 1930, the top surface was within about one ft. of the planned elevation, and the dam was within 1 inch of the calculated lateral measurements up and down stream. There was no shattering of the dam into fragments.

PURIFICATION. Almost any carbonaceous material is capable of being made active for adsorption and dechlorination. The greater amount of active carbon made from vegetable compounds is being manufactured by carbonizing matter such as lignite, waste pulp liquors, black ash residues, sawdust, woods and similar materials, in retorts under controlled conditions of temperature and atmosphere. "Hydrodarco" is made from lignite which is crushed to 2-4 mesh and continuously conveyed to a horizontal rotating retort, where it is destructively distilled at 900°-950° C. by external heat application. This treatment drives off the volatile matter and leaves fixed carbon in an extremely porous condition. The carbon is cooled out of contact with air, regulated according to size of particles, and the organic acid solubles are removed to adapt it to specific uses. "Nuchar" is made from paper mill waste liquors. The weight and carbon content of commercial activated carbons are as follows:

Material	Wt. per cu. ft.	Approx. % of Carbon
Bonechar	35.1	10
Cocoanut char	24.4	96
Hydrodarco	17.2	70
Minchar	41.6	10
Nuchar	9.1	93
Peach pits	21.2	98
Wood charcoal	9.8	97

In general, the hard materials are low in carbon content.

Activated carbon is used¹² for the removal of almost every kind of organic taste and odor, elimination of free chlorine, removal of organic coloring matter, and separation and removal of iron. But its dechlorination properties will most likely constitute its chief use in water purification. Organic matter is removed

either by direct adsorption by carbon, or by using an excess of chlorine to destroy it as completely as possible and then removing excess chlorine with carbon, the latter method being preferred. If carbon is used as an adsorbing agent for impurities, its active life will be limited to its adsorptive capacity, when it must be revived or discarded. If used as a dechlorinating agent, the pores of the carbon are less likely to be choked with organic matter, and the residual chlorine applied to the carbon is itself a revivifying agent to some extent.

In the case of turbid colored water, the method will frequently be found a valuable and economical adjunct to coagulation and filtration processes; in clear colored waters, coagulation and sand filtration may sometimes be dispensed with entirely. Ferrous iron in raw water is oxidized practically instantaneously to ferric iron by an excess of chlorine. This ferric iron hydrolyzes in normally alkaline water to insoluble ferric hydroxide which is removed by appropriate means, and the residual chlorine is removed by carbon.

Activated carbon installations have been made in packing and other food product plants with a capacity of $\frac{1}{4}$ m.g.d. or over; also in bottling plants, hotels, ice plants, department stores, and private estates, treating 50,000 g.d. or less. Experimental units have been installed for the municipal supplies at Chicago, Chester, Pa., and Pontiac, Mich.

In **designing a plant**, the activated carbon treatment follows sand filtration, since the highest efficiency is obtained when clear water is applied. There are separate basins for the sand and the carbon. If the sand bed is placed in the same basin and over the activated carbon, after the first backwashing the sand will work to the bottom and the carbon rise to the top. Confining the carbon by a screen may handicap the operation of the filter. Two-story construction is suggested by Baylis to conserve space and facilitate the operation of gravity units. Under existing sand filters, 8 to 10 ft. of clear well space is necessary for a carbon plant installation.

In the **operation** of an activated carbon plant, the water from the sand filter may flow downward or upward through the carbon. Higher rates may be used with downward flow, but there will be considerable friction loss through the bed. Downward flow will require more frequent washing due to clogging of the carbon. Upflow operation is preferable because it provides for greater simplicity in plant design and operation.

The carbon beds will require washing¹⁴ to remove the matter in the water passing the sand filters. The frequency of washing will depend upon the thoroughness of sand filtration. The washing of some carbons does not vary greatly from sand bed washing. With water filtered clear, Baylis has found 6 months between the washings of carbon beds sufficient.

The **operating advantages** of carbon treatment are that it functions automatically, accurately, and constantly. In 17 months operation at Chicago, the only attention to the carbon unit was washing the filter twice. In the case of small public water supplies, when the chlorine dosage increases to the point of producing objectionable tastes and odors at night or other times, the carbon treatment will prevent such tastes and odors.

After varying periods of use, **carbon filters will re-**

quire revivification. This is accomplished by applying a hot solution of 1 per cent NaOH, or passing superheated steam through the bed to maintain a boiling temperature for one-half hour. The alkaline solution treatment appears most favorable for removing adsorbed gelatinous organic and inorganic impurities, although complete information as to the effectiveness of this method is still lacking. The steam treatment appears best for removing adsorbed volatile taste and odor-producing compounds. When calcium carbonate is deposited on the carbon bed, acid treatment may be necessary. Drying at 105° C. revived the carbon where gelatinous compounds stopped up the pores.

The **cost of installing a carbon treatment plant** depends on whether a new water purification plant is to be built or an existing one utilized. For a 10 m. g. d. purification plant utilizing the two-story construction of Baylis, the activated carbon plant can be installed at a cost of approximately \$50,000 more than the cost of the sand filtration plant alone. The **cost of operation** should be small, due to infrequent washing, providing the carbon will not require frequent revivification or replacement. The **depreciation** factor will depend upon the life of the carbon. Incomplete data indicate that the life may be 2 years where the carbon is used only to remove tastes due to chlorine, chlorophenols, and other substances.

The **conclusions** from the 17 months' operation of a Hydrodarco filter at the Chicago experimental filtration plant are: (1) Fairly deep beds are preferred—a 48 inch-deep bed will reduce the residual chlorine to a lower figure at 4 g. p. sq. ft. p. min. than a 24 inch-bed at 2 g. p. sq. ft. p. min.; (2) the maximum upward flow to avoid suspension of material is 4 g. p. sq. ft. p. min. for 4-12 mesh Hydrodarco; (3) Hydrodarco will reduce the residual chlorine in 30,000 g. of water from 1.0 p. p. m. to less than 0.1 p. p. m. without revivification, using a bed 24 inches deep at 2 g. p. sq. ft. p. min. By revivification, it is believed 200,000 to 500,000 g. of water may be dechlorinated per pound of Hydrodarco.

At **Chester, Pa.**,¹³ where the Delaware River water containing objectionable odors and tastes due to wastes from oil refineries, paper mills, chemical plants, and organic matter of domestic origin is treated by pre-chlorination to produce a residual of 0.5 p. p. m. of chlorine, alum and lime coagulation, cascade aeration, sedimentation for 3 hours, sand filtration, secondary lime treatment to prevent corrosion, and secondary chlorination, the plant effluent is free from turbidity at all times and contains a residual chlorine of 0.2 to 0.4 p. p. m. Tests on the plant effluent in 1929 with glass tubing experimental carbon filters showed: (1) Hydrodarco is superior to Nuchar or Minchar; (2) Minchar (hard) can be used in place of sand with coagulated water; Hydrodarco and Nuchar, both soft, are used only with water free of turbidity and organic matter; (3) a rate of filtration of 2 g. p. sq. ft. p. min. gave the best results with this water; and (4) a 30-inch Hydrodarco bed on purified water at a 2 g. rate will remove all appreciable odor for about 1 year without regeneration.

Two tests were made at **Pontiac, Mich.**,¹⁵ using lake water strained through sand without chemical clarification before application to Hydrodarco. From Dec., 1929, to March, 1930, a straw-like hot odor and slight moldy odor were removed from the water by Hydro-

(Continued on page 78)

An Australian Engineer's Impressions of American Highways

By C. V. Vaughan, B.C.E.
Honorary Representative, American Road Builders' Association

FOLLOWING a visit to the United States and Canada last year, this article is an endeavor to set down some of the more salient facts about road construction which appealed to me during inspections made throughout the construction season.

By the concerted efforts of the engineers of the highway departments and other organizations, and also by the far-sightedness of legislators passing bills for extensive road building, America has earned the position of probably highest place in the scale of highway improvement in the world. One of the outstanding features noticed by visitors is the courtesy of the engineers in arranging for inspections and in supplying all data in connection with construction methods and costs, as well as specifications. The same friendly feeling pervades the numerous conventions where the presentation of papers and pooling of knowledge permits everyone to gain useful information whereby the honorable profession of roadbuilding constantly is being advanced.

The amount of research work carried out by the U. S. Bureau of Public Roads, the American Road Builders' Association, and by the various state highway departments is enormous, and the valuable digests of this important work are available to all through the various publications connected with the organizations. These field and laboratory studies are of tremendous economic importance, and younger nations have come to look upon these experiments as a possible solution to their troubles. In England a great deal of important research work is being carried on, but somehow we do not hear very much about it. I believe that by continued research and constantly published up-to-date solutions of old and new problems, America now occupies a position in the forefront of road building progress.

No other country has made the same use of mechanical handling methods. This results in lowering the cost of the unit of performance, but, while the mechanical age exists, there must necessarily be an enormous increase in the field of demand, to be able to absorb the workers who are displaced by the use of mechanical methods. Road gangs which used to put out 500 tons of hot mix per day in 1928 can now be halved by the use of the mechanical raker and finisher. These machines give an excellence of finish which is likely to make them very popular with the highway departments.

The design of roads of all types has been successfully attacked in the many states. Generally speaking, cement concrete is in the forefront on country roads, with asphaltic concrete closely following. The U. S. Bureau of Public Roads has conducted some



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Above: Semi-penetration bituminous macadam.
Below: Penetration bituminous macadam on strengthened water-bound macadam on boulders

TWO TYPICAL AUSTRALIAN ROADS

fine experiments on design, and the collaboration of the state highway officials has brought about successful standardization. Concrete with doweled center joint, thickened edge, and asphalt mastic expansion joints seems now to be standardized. Asphaltic concrete, with exposed aggregate as laid in the West, has a greatly increased non-skid quality. Asphaltic pavements will always enjoy the economic advantage of adaptability to progressive improvement, all the time realizing the full salvage value of the previously existing roadway.

The progress made in investigating low-cost roads has been great indeed, and therein I believe has the greatest advance been made. Mulch treatment, sand-asphalt, mix-in-place retread, and oiled earth are some of the names given to the low type of improved roadway to which the world might well pay attention. Every country has countless miles of roads which such treatments would benefit, while it is only the heavily travelled trunk routes which warrant the expensive, high-type pavement.

Australia is one of the countries vitally affected. Australia has no oil fields, an area equal to that of United States, only 6½ million people and a registration of 670,000 motor vehicles. Gasoline costs 44 ct. per U. S. gallon in the capital cities and up to 65 ct. only 200 miles inland. Naturally enough, mileages are great and the traffic comparatively light, but still we must have roads to develop the country.

(Continued on page 66)

Machine Finishing of Black-Top Pavement

Reduced Labor Costs

Bewley & Gould Paving Company used mechanical finisher to speed construction on a New York State road.

THE machine method of spreading and finishing asphalt pavement was introduced into New York State highway work in 1930 in connection with the laying of approximately three miles of Type M.M. 4 pavement on a contract awarded to William J. Gallagher of Medina, N. Y., by the New York State Department of Public Works, Division of Highways, in April, 1930, for the reconstruction of the Pembroke-Batavia highway. The greater portion of the contract was for reinforced concrete, with the exception of the three-mile stretch, which was specified as Bituminous Macadam M.M. 4, or Amiesite (both materials being identical in content, method of mixing, application, etc.), 7,125 tons of this material being called for.

The laying of the M.M. 4 pavement was sub-let by Mr. Gallagher to the Bewley & Gould Paving Company, of Lockport, and prosecution of the work was carried on entirely by the latter concern under the usual State supervision in all details. Permission was granted the subcontractors by Howard E. Smith, District Engineer of the New York State Department of Public Works, Rochester District, to use finishing machines on the work for spreading, striking-off material and finishing the pavement, provided the general specifications of the Department could be met through such method.

The original road which was to be improved under the above contract consisted of two ten-foot concrete strips with a six-foot strip of macadam in the center, giving a total width of improved surface of twenty-six feet. The reconstruction work consisted of widening the road to a thirty-foot width with two strips of concrete, one on each side two feet wide, with a one-foot curb at each edge. The remaining twenty-eight feet of top was surfaced with Type M.M. 4 material, consisting of a 1½-inch binder with a ½-inch top. The curb at each side furnished a solid means of support for the finishing machine, very similar to that afforded by the steel forms used on a concrete pavement job.

The asphalt mix used in reconstructing the above stretch was very similar to asphaltic concrete, except it is laid and manipulated while cold, a cut-back being added when necessary to keep the mixture workable until spread and rolled. The cut-back consisted of a very high grade of kerosene with about fifty per cent of gasoline. In preparation of the M.M. 4 material, the stone is first dried and then cooled to a temperature of 95 degrees F. before mixing. The asphalt is kept at a temperature of about 275 degrees F. at time of mixing. Final temperature, after three minutes of mixing, is around 110 degrees. The entire preparation of the asphalt material was performed at a permanent central mixing plant owned and operated by the Republic Asphalt Company, located at Strat-

ford, N. Y. This material was furnished by the producer in accordance with departmental specifications and hauled a distance of twenty-four miles to the site of the work.

The mix used for binder course and top course varied, of course, in accordance with specifications for these two items. The following tables show the weight and percentages of the different ingredients in each course.

Mix Used for Binder Course

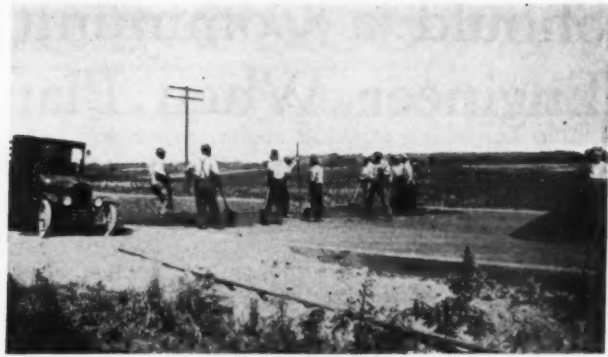
By Weight for 1 Ton Batch	By Percentages
1838 pounds coarse aggregate	86 to 92%
90 " asphaltic cement	4 " 6%
10 " Lime	0.5 " 1%
60 " mineral filler	3 " 6%
1½ Gals. Liquefier	(1½ Gals.)

Mix Used for Top Course

By Weight for 1 Ton Batch	By Percentages
1710 pounds Stone	83 to 90%
110 " A. C.	5 " 8%
170 " filler	5 " 9%
10 " Lime	0.5 " 1%
2 Gals. Liquefier	0.4 " 1%

As the entire contract was closed to traffic, no difficulty or inconvenience was experienced from this angle, and a full width 30-foot finisher was used for virtually the entire section of the M.M. 4 pavement, but hand spreading and raking methods were employed on certain curves and other points where the Department refused the contractors permission to use the machine method. Prior to the arrival of the finishing machine on the job, all material was dumped in piles and entirely hand-shoveled and hand-raked. Upon introduction of the machine method of finish, it was found that a more satisfactory method of distribution of material could be obtained when the end-gates of the dump trucks were tied so as to permit a six-inch opening and a uniform spread of the material in three lanes across the entire width of the road, thus eliminating a large amount of shoveling and raking which would have been necessary under the former methods employed. The method of distribution suggested the possible economy of spreader boxes for such operation, but doubt was expressed as to the justification for the additional expense which this equipment would entail, although the above mix could have been handled and distributed satisfactorily with the use of spreader boxes.

Approximately 1,200 tons of the total 7,125 tons of asphaltic material had been hand-spread, raked and finished, before the finishing machine was placed in operation on this contract. Laying of the asphalt with the finisher was started on July 24 and worked satisfactorily from the start on both binder and top, in spite of the fact that the operation was regarded virtually as an experiment by both contractors and engi-



Above—Material dumped in piles and shovelled and raked by hand at first. Below—Later, material distributed by dump truck with end gate tied partly open, and finished by machine.

neers, as mechanical finishing methods had never before been employed on similar work under supervision of the New York State Division of Highways.

A comparison of the number of workers employed under both methods of operation suggests the extent of pay-roll savings made possible through the use of the machine method as opposed to hand work. In addition to the labor saving feature, it is said that the machine method of spreading and finish presents the advantage of uniformity and accuracy in finished riding surface, the smoothness of which is controlled by the contour of the curb or forms on which the finishing machine rides, as is the case with mechanically finished concrete pavements. The finishing machine enabled the paving crew to operate with six men less than were required under the hand method, displacing three shovelers and three rakers. As an instance, on July 23, the day before the machine was placed in operation, the paving crew consisted of:

- 1 Foreman
- 4 Rakers
- 8 Shovelers
- 1 Truck dumper
- 1 Curb painter
- 2 Roller men

Total—17

It had been the intention of the contractors to add more hand rakers to the above crew later, in the event the machine was not used, as it was felt that satisfactory production could not be maintained consistently without additional men. A representative day's operations in August showed that the machine method of laying and finishing required the following crew:

- 1 Foreman
- 1 Raker
- 5 Shovelers
- 1 Truck dumper
- 1 Curb painter
- 2 Roller men

Total—11

On August 15, a representative day for purposes of comparing progress under the two different methods, a production of 160 tons of top was obtained and 91 tons of binder. This tonnage of top material represented the surfacing of 4,665 square yards of pavement and the binder represented approximately 1,200 square yards. The road crew was engaged about 65% of the time on the top work on this particular day and about 20% on the binder. The cause of this comparatively low efficiency was due to limited capacity of the plant furnishing the material, the twenty-four mile haul to the site of the work, etc.

Two separate finishing operations are, of course, required on a contract of this type, one for compaction and finish of the binder course and one for the top course; each course being rolled separately by power rollers working immediately after the finishing machine. On the above contract the concrete curb furnished satisfactory riding forms for the finishing machine. The contractors found from experience on this job that it would perhaps be advisable on the average contract where curbing is used as a means of support for the machine, that the curbs or header be straight-edged in order to prevent irregularities in the pavement surface, since the accuracy of the "forms" is a controlling factor in smoothness of finished surface.

(Continued on page 64)

Should a Community Retain a Consulting Engineer When Planning for Incineration?

The author states in outline the factors which are involved in a study of the subject and in the preparation of plans and specifications, and concludes it should

By Alden E. Stilson
Morse-Boulger Destructor Company

SUCCESSFUL cleansing of an entire community by any means demands intelligent forethought and careful planning. When a municipal governing body is confronted with the problem of disposing of its refuse, the question arises—Who is qualified to guide it in reaching a solution and to prepare plans for carrying out the method chosen? Should the municipality retain a consulting engineer for that purpose?

An attempt is made below to outline the interrelated factors which are involved in a thorough study of the subject. This outline is, of course, general, for communities differ widely and no one list can be a perfect fit for all of them.

Incineration has rapidly become the accepted method of disposing of refuse, and it is assumed that it will be selected for the case in question.

Planning a Disposal System:

1—The Community:

- (a): What is the present area and population to be served?
- (b): What is the probable future growth to be expected?
- (c): What will be the direction of growth when it comes?

2—Production of Refuse:

- (a): What are the sources of refuse?
- (b): What is the present and probable future production?
- (c): What is the character of the material collected?
- (d): What will be an adequate plant capacity to handle the present and provide capacity for the future?

3—Collection Service and Equipment:

- (a): How shall collection be arranged for?
 - 1—Shall it be by municipally owned vehicles?
 - 2—Shall it be by contract with a private individual?
 - 3—Shall it be by collectors arranged for by property owners?
- (b): How shall homes, restaurants, hotels, hospitals, and business houses be served?
- (c): How shall ordinances be written to satisfactorily insure service and cooperation?
- (d): What type, capacity and number of vehicles will be necessary?
- (e): What personnel and supervision will be required?
- (f): What will be the cost of maintenance and operation?

4—Plant Site:

- (a): Can the present dumping grounds or city-owned lands be used?
- (b): Can a central or more suitable location be found?
- (c): Can the site be properly landscaped?

A preliminary inspection trip will undoubtedly be of much assistance, but care should be taken to select communities of similar nature and type, so that the adaptability of their system may be directly compared with the service probably necessary in the community in question.

The proper answers to the questions proposed above will serve as an excellent foundation for the preparation of definite plans and specifications inviting bids.

Suitable plans and specifications will include the following:

1—Specific instructions relating to:

- (a): Qualifications, surety bonds, certified checks and insurance.
- (b): Subletting of contracts.
- (c): Form of bid, contract and arrangement of payments for work.
- (d): Unit prices, lump sum bids and extras.
- (e): Supplemental plans and specifications to be provided by the bidders.
- (f): Statements and guarantees required as part of the bidder's proposal.

2—Exact definitions governing:

- (a): The garbage, its analysis and the proportion of garbage by weight to be burned.
- (b): The rubbish, its analysis and proportions of rubbish by weight to be burned.
- (c): The authority in all matters and the settlement of disputes.
- (d): The time of starting and completion of the work, including penalties and liquidated damages.
- (e): The testing and final acceptance of the plant.

3—Available data and conditions relating to:

- (a): The site and safe load bearing ability of the soil at the site.
- (b): The piling, sheet piling, ground water and minimum depths of acceptable foundations.
- (c): The nature of excavation, grading, back filling and landscaping.

4—Detailed drawings of the building showing:

- (a): Desirable overall heights.
- (b): Grades, elevations and contours to be maintained.

5—Detailed building specifications governing:

- (a): Quality of materials and strength of finished work.
- (b): Miscellaneous work or equipment, not a part of the incinerator equipment.
- (c): Ventilation, door and window openings, plumbing, heating, lighting and painting.

6—General incinerator specifications governing:

- (a): Exact capacity of furnaces desired.
- (b): Capacity and volume of ash handling equipment if desired.
- (c): Minimum height and diameter of chimneys required.
- (d): The quality of materials used in the construction of incinerators and chimney.
- (e): Substitutes, if bidders can demonstrate superior, or equivalent material.

7—Schedule showing:

- (a): How bids will be adjudicated.
- (b): What shall determine the most satisfactory, economical and advantageous bid for the municipality to accept.

When a definite set of specifications and plans has been bid upon, and equally definite proposals have been received, the various contractors or their representatives may be given a definite and prearranged hearing, with ample opportunity to discuss the merits of their respective proposals.

From what is actually stated in the proposals and by the bidders, the least acceptable proposals can be

(Continued on page 86)

THE EDITOR'S PAGE

In the Name of Unemployment Relief

Every responsible city official is being importuned now to create jobs for the relief of unemployment. The same is true, in a large measure, of state, county and township officials.

To create such employment is truly an important function of those responsible for our governmental policies; and it is especially pleasing to know that there exists in the great field of public improvements such a reservoir, which can be used to succor the needy in times such as these. Public officials should cut red tape and make every effort to speed needed construction.

But there exists a grave danger that in the scramble to make work available—*any kind of work*—the real needs of the communities will be lost sight of. In too many cases the unemployment committees have been made up of those who feel a greater degree of responsibility to the would-be-worker than to the community. Though they are earnest men and women, they are unfamiliar with construction problems and with civic needs, are scarcely capable of outlining policies that will produce work, and still serve the taxpayers of the community.

What will happen too often is that work of no real value—unnecessary work and even useless work—will be set under way. Perhaps the reason will be that needed works will require a little more time to start, or will not employ quite so many of the unemployed, or will not be susceptible of the right kind of publicity.

The result: A good many communities are liable to find themselves in the spring with construction funds spent, in debt, and nothing tangible in the way of needed improvements.

Let us cite the case of one city. With a program calling for progressive drainage improvements over a period of several years—which improvements are vitally needed to facilitate the growth of the city—the officials were urged into the purchase of a large tract of unimproved land, so that the unemployed could be set at work cutting brush, clearing, etc. There will be no money left for drainage work, and the city will be in debt. Temporary and unsound relief may occur, we grant. Is it worth it? Could not the engineers of that city, given the opportunity, have provided a better program—better for everyone concerned?

An Editorial by the New York State Department of Health

This state has had serious droughts during the summer months for two successive years. In 1929 many communities experienced severe shortages of water, and were forced to use polluted auxiliary supplies which were made potable only after continuous and effective treatment.

Last spring this department sent out a warning to all water works authorities calling attention to a deficiency of rainfall during the first four months of the year. Municipalities having supplies usually affected by droughts were warned to provide for the acquisition

of good auxiliary sources. Some communities heeded this advice; others failed to develop an additional supply and many were obliged to resort to the use of seriously polluted water.

Last summer, when the water supply of a certain village reached a dangerously low ebb, water from a grossly polluted source was pumped into the mains. Fortunately, this fact was discovered by a member of the staff of the Division of Sanitation before there was time for the sewage-polluted water to displace the pure water in the mains. Ready cooperation of the city officials in following out orders for heavy chlorination of the supply, and notices to boil the water undoubtedly saved the community from a severe outbreak of typhoid fever or other intestinal disease.

In another municipality, manufacturing firms lost several hundred thousand dollars when they were forced to shut down for a period because of insufficient water to carry on their work.

All water works officials in charge of water supplies which are subject to depletion during droughts are, therefore, earnestly urged to make provision immediately for emergency sources of unquestionable sanitary quality in order that the public health may be conserved.

A penny-wise policy in a matter of this character frequently pays large dividends on the wrong side of the ledger.

The above appeared in a recent issue of "Health News." Its applicability is not confined to New York State—in fact, that state was affected less seriously than many others.

We're for Bigger and Better Cameras

In almost every mail we receive manuscripts for publication, some solicited and some otherwise. Mostly, we're mighty glad to get these. We'd be gladder yet if they were accompanied by photographs of a reasonable size. Too many engineers apparently expect a small camera to give more satisfactory results than could reasonably be anticipated. Theoretically, pictures that can be produced by such equipment can be enlarged. Practically, the successful use of these small photographs is limited to close-up views of equipment. To employ them for recording general views of construction on a cloudy day, in the winter about 4 P. M., or with billows of dust blowing about (at least that is the way it looks) is entirely too optimistic.

The small camera is handy to carry about, but equipment using the post-card size film, about 3¼ by 5½ inches, is about as small as can be used for satisfactory illustrations of general all-around work on construction.

We have been glad to note in the past few years an increasing use of the camera among engineers, and feel that it is a step in the right direction to record the progress of construction work by such means. But to be of practical use, the pictures should be large enough to bring out clearly the details which it is intended to record pictorially for future reference, or for the information of those who can not fill them in from their personal knowledge of the work.

More Than a Mile of Twenty-Foot Pavement in a Week

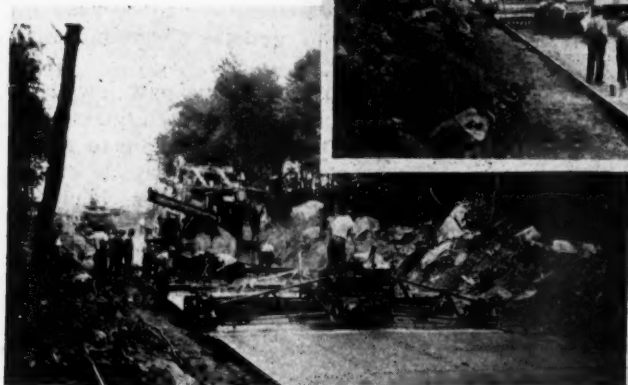
MAINTAINING an average speed of 818.4 feet per day of 20-foot concrete highway, with a thickness of 9 inches at the edges and 7 inches in the center, M. Bennet & Sons, Indiana, Pa., completed the concreting of a 5.58-mile section of state highway in Cambria County, Pa., in 36 working days. Paving was started near Belsano on July 21, and was completed on September 2.

Nearly the entire stretch was new location, which afforded a layout with but three curves in the 5.58 miles. The excavation involved amounted to about 140,000 cubic yards, which was handled by four P. & H. gasoline shovels with 1¼-yard buckets. Hauling and grading equipment included 2 Linn tractors, trucks, 8-yard Streich wagons and 6 Caterpillar and 1 Monarch tractors. Grubbing of the stumps was accomplished largely with the shovels (most of the right-of-way was through second-growth timber), but the tractors cooperated on the larger stumps and on boulders.

The material plant was located at Ebensburg, with a dead haul of 2.1 miles and a maximum haul of 7.68 miles, giving an average haul of 4.89 miles. Transportation of the materials from the plant to the mixer required at first, due to the long haul, 22 3½-ton trucks, including G. M. C., Dixon, Relay and Autocar, each truck carrying three batches of six bags each. As the job progressed the transportation decreased so that when the middle of the project was reached, only 17 trucks were required, and near the Ebensburg end of the work, only 10 trucks were used. Two 1-ton trucks were employed to haul calcium chloride and return empty cement bags.

The equipment at the loading plant included a P. & H. shovel with a capacity of 1¼ yards; a clam of the same make, with a 1½-yard capacity, and Blaw-Knox batcher and bins with a capacity of 60 tons. All materials going into this pavement were proportioned by weight. The railroad siding was extended to carry 10 cars, and two shifts per day were made by the railroad.

Scenes on the M. Bennet & Sons job near Belsano, Pa. Below, a Lakewood screen follows the mixer closely.



The materials used in the pavement were: Slag, as a coarse aggregate, which was obtained from the Standard Slag Co., Johnstown; Penn-Dixie and Hercules cement; and sand from J. K. Davidson and Iron City.

The paving equipment on this job was a 27-E Rex mixer, using a 6-bag batch, proportioned 1:2:3. This mixer was used from July 21 until August 26, when a new automatic 27-E Koehring paver was put in operation, and used to complete the work. The timing device on this mixer was set at 1 minute and 18 seconds. The finishing machine was a Lakewood screed, and the center joint was of the cleft type.

Two Barnes pumps supplied the water. Some delay was experienced in securing sufficient water, due to the prolonged dry weather, it being finally necessary to pump the water six miles from Ebensburg. About 4,000 feet of Blaw-Knox forms were on the job.

Thirty men used at the mixer were as follows:

- 1 foreman
- 1 mixer operator
- 1 man operating finishing machine
- 1 man at calcium chloride
- 1 man oiling forms
- 1 man operating Flex-Plane machine
- 2 men handling steel reinforcement
- 2 men on the subgrade tester
- 5 men in pit
- 2 men spading
- 1 man on trucks as they dumped into skip of mixer
- 3 finishers
- 3 men on burlap for curing purposes
- 3 men sprinkling for curing purposes
- 3 men baling the empty cement sacks

As high as 1023 feet of completed pavement were laid in one day of 13½ hours, and during the week



Above: There were enough batch trucks so that the mixer kept going all the time. Left: This truck has pulled ahead a little too far after dumping its batch into the skip.

of July 28 to August 2, 5,316 feet, or more than a mile of pavement, were completed, working an average of 13½ hours a day. This also included pouring culvert headwalls, which was done by the mixer.

The senior inspector in charge of the work was W. S. Balint, who was under the direction of Assistant Engineer E. J. Finn.

Nashville Filtration Plant

A BOARD of engineers, after making an exhaustive study of the water works of Nashville, Tenn., in 1919, made a number of recommendations, including the construction of a filtration plant of 24,000,000 gallons per day capacity, estimated to cost \$737,150. Contracts for this were not let until about eight years later, or in August, 1927, and the plant was dedicated in October, 1929. In the meantime, most of the other recommendations of the engineers had been carried out, including a new pumping plant, several miles of large mains, a 3,000,000 gallon reservoir and other improvements. During the eight years the city had grown so rapidly that instead of a 24,000,000 gallon filtration plant it was decided to build one of 28,000,000 gallons capacity. The wisdom of this is evident from the figures for consumption in 1930, which shows more than 32,000,000 gallons consumed on some days during that year.

The filtration plant designed by the J. N. Chester Engineers, is of the conventional rapid sand type, with mixing chambers and coagulant facilities. There are, however, some features out of the ordinary which were mentioned by John F. Laboon in a paper read by him before the American Society for Municipal Improvements.

There are six mixing chambers, each divided into two parts and each part equipped with an individual motor-driven agitator, one providing for more violent agitation than the other. The raw water enters the first mixing compartment at the top through two sluice gates, where



Entrance to the filter room

it is subjected to violent agitation. Then the mixed water passes into the next compartment through a large opening at the bottom of the dividing wall, where a less violent mix is given it, after which the coagulated water enters the distributing flume through two sluice gates and on into one or both of the settling basins. The treated water of one pair of mixing compartments may be given additional agitation by connecting two sets of mixing compartments in series by means of sluice gates located in the raw water by-pass flume.

Twelve filters have been provided, six on each side



General view of filter building and reservoir

of the pipe gallery. The walls of the filters extend three feet above the operating floor, thus making inspection of the filters easier than where the water surface is below the operating floor.

The filters are equipped with concrete false bottoms, bronze tubes and strainers, 18 inches of graded gravel, 30 inches of sand and steel wash troughs with their tops 24 inches above the sand. The building walls enclose the entire area of the filters. Under the filters on each side of the pipe gallery is located a clear water well having a capacity of 300,000 gallons. Two sand washing bins equipped with weirs and screens are located in the basement of the headhouse.

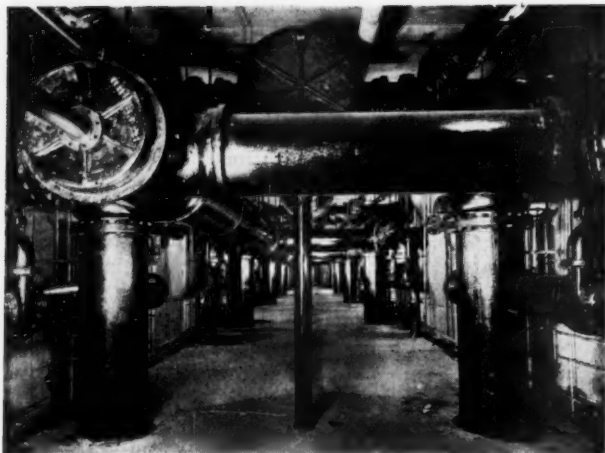
Careful attention has been paid to the appearance of the filter building. Terrazzo was used for the exterior



Interior view of filter house, Nashville water works.



General View of filter building



View of pipe gallery

faces and tops of the filter walls above the operating floor, for the operating floor, and the floors of the headhouse lobby, hallways and toilet rooms, and the stair treads; the operating floor being of squares alternately colored and separated by brass strips. The walls of the filter room are finished in red brick; the entrance is of Caen stone with buff brick above. The roof over the operating floor is of Spanish tile.

The final estimates for the plant totaled \$587,432, or \$20,980 per million gallons capacity. Of this the excavation, grading, concrete work and piping cost \$297,912, the superstructure \$139,248, and the filter equipment \$136,176.

Gas Tax for Township Roads in Minnesota

By N. C. Nickerson

County Highway Engineer, Carlton County, Minn.

At its last session, the legislature of Minnesota passed a much needed and a timely act diverting one-third of the gas tax from the trunk highway fund to the use of the counties of the State for the construction and maintenance of county and township roads. At the same time the gas tax was raised from two to three cents, so that the counties now receive about three million dollars a year from this source.

This money is distributed by the State to the counties in quantities ranging from three-fourths of one per cent to three per cent of the total funds thus derived, the exact amount depending upon the number of miles of road in the county and the traffic thereon.

A further provision of the act requires the money thus distributed to be expended under the supervision of the county boards and their highway engineers. It also provides that not less than twenty per cent nor more than fifty per cent of these funds shall be used for maintenance on those roads that the townships proposed be designated as "county aid" roads and which were so designated by the county boards if they were contained in the system laid out by the county highway engineer. The county is held responsible for the maintenance of these roads, but the township must pay from ten to thirty per cent of the cost of their construction.

The act was passed at a time when counties and townships with small assessed valuations were having a hard time to keep their roads up to the demands made upon them. The act has been in force for two years now and has proved entirely successful and of great benefit to the tax payers and the traveling public.

In this (Carlton) county, the townships have been able to turn over the construction and maintenance of their most important and heaviest-travelled roads to the county. Consequently there has been developed a standard plan of construction, and regular, consistent and uniform maintenance. These roads are re-built and improved during the summer and kept free of snow during the winter, and every effort is made to keep them in the best possible condition for the traffic which uses them. In fact, this work has been so well done and the results of this law have been so satisfactory that the townships would like to have all of their roads designated as county aid roads and they in turn would turn over all of their road money to the county. One county of the State voted on this proposition at the last election but the results are not as yet known.

In any event it is certain that, in counties which are made up of townships of small valuation, a centralization of the road building activities will produce better aggregate results, as is evidenced by this highly successful gas tax law of Minnesota.

Again referring to this county, which has only a ten million dollar valuation but which has a thousand miles of road, thirty thousand dollars was received this last year from the gasoline tax and was expended on its one hundred and fifty miles of county aid road as follows:

Maintenance of the system.....	\$10,000
Construction of 9.5 miles.....	20,000

The townships contributed about eight thousand dollars as their share, and with this twenty-eight thousand dollars nine and one-half miles of road were built to standard grade and cross-section.



A typical county road built by gas tax

Reports on Highway Matters by the A. R. B. A.

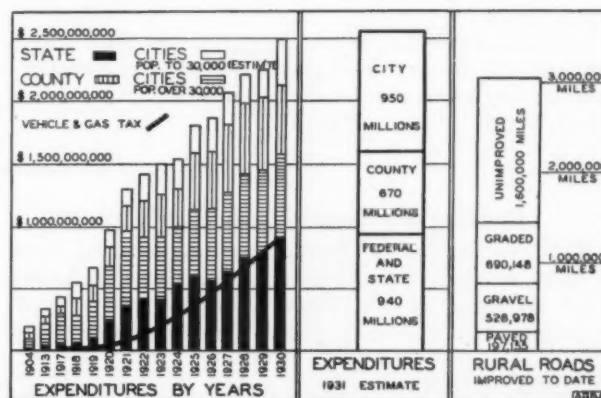
The American Road Builders' Association, through its officials and numerous committees, is continuously investigating and frequently reporting upon the various features of highway design, construction, maintenance and administration. Many of the reports discuss their subjects more or less exhaustively and present voluminous data, desirable for study of the subject by experts but overwhelming to others. We present below abstracts of several of these reports or of portions thereof, through the courtesy of the Association, from whom the complete reports can, we believe, be obtained.

Employment and Highway Expenditures in 1930

Predictions of an expenditure of \$2,500,000,000 for city, county and state road and street construction in 1930 have been fulfilled, according to C. R. Thomas, engineer executive, City Officials' Division, American Road Builders' Association.

Construction programs as affecting employment are of importance because of the number of people affected. It is found that about half of the expenditures on highways goes to wages for men directly employed thereon. Estimating that an expenditure of \$5,000 gives employment to one man for the construction season, the \$2,500,000,000 program of 1930 gave employment to some 500,000 men engaged in the actual construction and maintenance of roads.

In addition, the production of between \$50,000,000 and \$100,000,000 of road machinery and special devices for road building which were used for this work kept many thousands of men employed in factories. A large part of the crushed stone and the Portland cement industry is dependent on the building of highways. Asphalt is extensively used for roads. The sand and gravel business employs many more thousands and there are many other materials that find a use in road building, and in the manufacture of which many people find gainful employment.



Expenditures over a period of years by state, county and city, with an estimate for 1931. Also the status of road improvement

of the program in 1930 and the "progressive plan" or "stage construction" of road building were recommended.

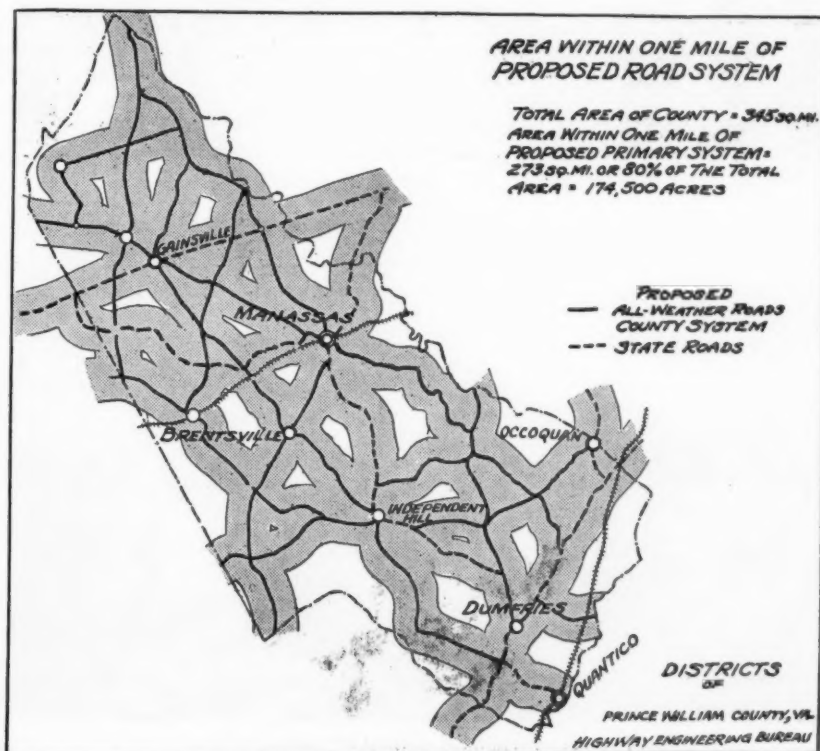
The finance plan is based on anticipated gasoline tax income, a county road tax levy applied to an increasing taxable value, and the floating of five \$100,000, 20-year serial bond issues, each with 5-year deferment periods. An increase in the present tax rate

How Sparsely Settled County in Virginia Financed Road Building

By the selection of a definite mileage of roads and the capitalization of the funds of the county, an economic program of road construction was evolved for Prince William county, Virginia, an agricultural county of 15,000 population located about 30 miles from Washington, D. C. This program is the result of a study made by the highway engineering bureau of Washington for the National County Roads Planning Commission, as an educational measure for the development of highways by means of intensive study of existing transportation needs and economic conditions.

It was understood that satisfactory highways must be provided within a reasonable length of time, while the methods of financing should not place too great a tax burden on the community.

Maintenance from the beginning



during the period beginning in 1935 and continuing through 1942, with a maximum increase of less than \$0.20 per \$100 valuation, was required.

It was estimated that there were 900 miles of roads in the county. Of these, 118 miles were designated as a proposed primary county road system, and 185 miles selected as secondary roads, and it was suggested that 46 miles of county roads be taken over by the state. This plan gives 1.17 miles of roads per square mile of area, and 80% of the total area of the county within a mile of an improved road. (It was estimated that 60% of the county's farms were located on unimproved dirt roads.) The primary roads were to be widened, drained, surfaced and relocated where desirable, while the secondary roads were to be maintained only.

The General Assembly of Virginia provided that a part of the former mileage could be discontinued; thereby funds can now be used to improve to a greater advantage a smaller mileage.

The tax problem in the county was favorable when compared with that of adjoining counties; more than one-half of its tax revenue was being expended for school purposes and less than one-third for roads.

As compared with the proposed finance plan, the "pay-as-you-go-plan" would require 14 years for completion; the rate of construction is slow, and losses due to automobile operating costs alone would more than equal the total cost of the proposed road system.

Summarizing: (1) By proper planning and selection it was found that improving 45% of the original road mileage would put 80% of the property in the county on or within a mile of an improved road. (2) By the capitalization of future county funds, \$500,000 can be raised with only a slight increase in tax rate, and that increase for only a few years. (3) By such a plan, many years will be saved in the completion of the county road system and automobile operating costs will be saved to an amount greater than the cost of the entire improvements.

Grading Equipment and Overhaul

Fully 95 per cent of the road grading work in Iowa is earth moving, according to F. H. Mann, assistant chief engineer of the Iowa State Highway Dept. During the past twenty years there has been little

change in loading equipment but great change in hauling equipment, which permits the contractor to run his excavator to the limit of its capacity and haul the material to the dump at far greater speed than in former years.



The old hand labor method of grading roads



The new mechanical method of grading roads

In Iowa, special consideration is being given to the effect of this change in hauling equipment on the overhaul problem. It is agreed that the overhaul specification, written for the old conditions, does not fit the new ones. The standard practice in that state is to pay 2 cents per station-yard for all material hauled more than 500 feet. Why 2 cents or why 500 feet is a question. Other states report free haul limits varying from 300 feet to one mile. It is a question whether there is any logical reason for most of these limits.

Procedure in Purchase of Highway Equipment by States

Recommended procedure for the purchase of highway equipment by states, as outlined in a report of the committee on Standardization of Methods of Purchasing Equipment of the A. R. B. A.

Formal public lettings, informal public lettings, and purchase by negotiation are defined as follows:

Formal public letting is a letting at which proposals are received, opened and read at a specified date and hour after the letting has been advertised for a definite period in newspapers and periodicals.

Informal letting is one at which proposals are opened and read publicly at a specified date and hour after requests for bids have been sent to a selected list of companies by mail or otherwise.

(Continued on page 74)

At the ROAD SHOW

THOSE who attend the Road Show will find a cordial welcome awaiting them by the advertisers in and the publishers of PUBLIC WORKS.

The editors of this journal look forward with particular pleasure to greeting visitors at booth number 76A.

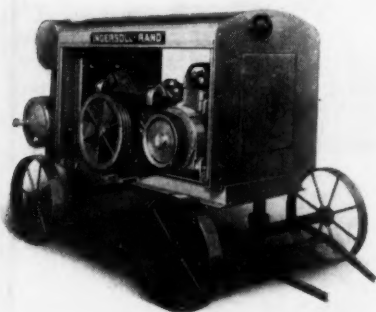
If, unfortunately, you are prevented from making the trip, you will find descriptions on the following pages of most of the important exhibits and illustrations of the latest types of equipment on display.

PUBLIC WORKS

Ingersoll-Rand Co.

Ingersoll-Rand Company, 11 Broadway, New York, will exhibit the following equipment:

X-71 drifter type rock drill on Type D wagon mounting; Type 20, 10 x 8 portable compressor on rubber-tired wheels; Type 20, 5½ x 5 portable com-



Ingersoll-Rand 30-ft. Portable Compressor

pressor on steel wheels; cross-sectional assembly of the free air unloader used on Type 20 portable compressors; Type 30 air-cooled portable compressor of 30 c.f.m. piston displacement; No. 50 drill steel sharpener; complete display of "Jackhammers," paving breakers, and pile drivers; complete line of pneumatic tools for road and bridge work.

The Ingersoll-Rand exhibit will occupy booths B-54 and B-69, located in the central portion of Exhibition Building B.

The exhibit will be in charge of George Williams, Manager of the portable compressor department of the company.

International Harvester Co. of America

The International Harvester Company of America will occupy space A-16. The exhibit will consist of several of the latest models of industrial tractors and motor trucks of various sizes and types adapted to road building. Among the unusual exhibits will be the International Six-Speed Special equipped with dump body and revolving on a turntable. A beautifully fin-



McCormick-Deering tractor.

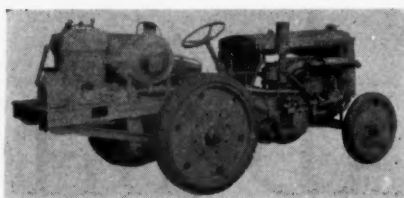
ished cut-out chassis of the Model A-5 motor truck will also be shown. This will be operated by an electric motor. In the industrial tractor line there is a white enameled cut-out industrial tractor operated by motor.

The exhibit will be in charge of William Parrish of the industrial tractor sales department and G. B. Abbott of the motor truck sales department.

Metalweld, Inc.

Metalweld, Inc., Philadelphia, Pa., will exhibit a combination consisting of a 110-ft. Metalweld-Worthington compressor mounted on an Allis-Chalmers Model "U" tractor. The mounting is such that it offers no interference to the general utility of the tractor.

Another piece of new apparatus to be



Metalweld compressor on Allis-Chalmers tractor.

shown for the first time is the new 75-cu. ft. portable, towabout type.

Both these machines have performed most impressively in practical tests on actual contract work.

The Asphalt Kettle Speeds Up

At booth B-43 will be found an asphalt kettle equipped with Timken roller bearings and pneumatic tires. Littleford Bros., Cincinnati, Ohio, claim that this outfit, style No. 84-HD, can be trailed 30 or 35 miles an hour. Not only that—the oil burner that heats the asphalt can be kept in operation while the kettle is being trailed. Asphalt can be melted on the way to the job.

Other outfits displayed by Littleford Bros. are: The Trail-O-Heater, a 300 gallon asphalt kettle; a motor driven emulsion sprayer; concrete heaters with universal attachment for tilting and non-tilting drum mixers; the heavy

duty All-Steel tool box for highway departments and contractors; the No. 90 Combination Tool Heater and A. C. kettle.

The Littleford Bros. display, booth B-43, is under the charge of L. W. Glaser, sales manager.

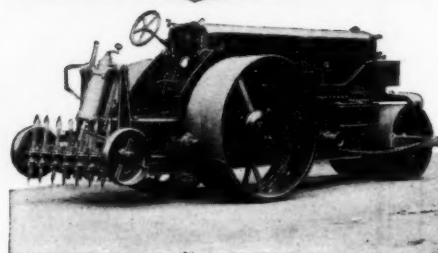
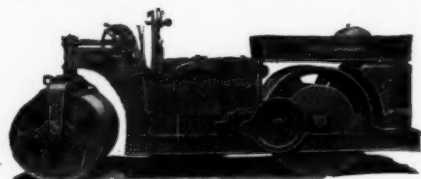
National Steel Fabric Co.

The National Steel Fabric Co., Pittsburgh, Pa., will exhibit in space A-64-B styles of electrically welded fabric and equipment for handling fabric.

H. H. Robinson, St. Louis district manager, will be in charge of the exhibit. Others in attendance will be: Robert L. Glose, manager of sales; C. B. Dugan, H. D. Stone, A. J. Marr, J. C. Kinzy and W. S. Edge.

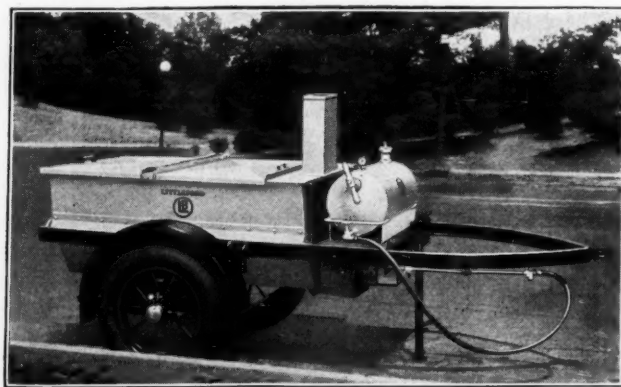
Buffalo-Springfield Roller Co.

The Buffalo-Springfield Roller Co., Springfield, Ohio, in their space A-54 and A-60 will exhibit the following rollers: 5-ton Buffalo-Springfield with scarifier and grading blade, 8-ton Buffalo-Springfield with scarifier and grading blade, 10-ton Buffalo-Springfield



Two of the Buffalo-Springfield rollers.

with scarifier, 15-ton Buffalo-Springfield with scarifier, 10-ton Buffalo-Springfield motor tandem.



Littleford 84-HD asphalt kettle.



South Willard Street, Burlington, Vermont,
paved with Standard Refined Paving Asphalt.

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Standard Asphalt Binder A
for surface treatment

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for penetration work

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for the mixing method

Standard Asphalt Joint Fillers
for brick or block pavements

Standard Cold Patch Asphalt
*for repairing all types of
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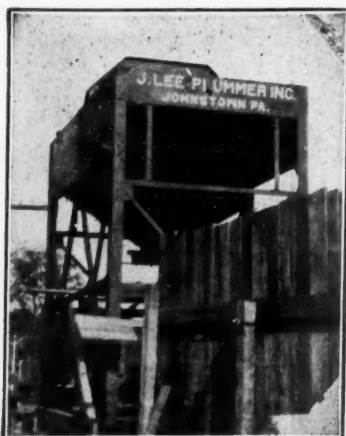
The Hercules Co.

The Hercules Co., Marion, Ohio, manufacturers of road rollers, will exhibit in space B-51. There will be shown a complete line of Hercules Rollers, Models 60, 80, 100, 120 and 150, all 3-wheel gasoline driven types of latest design.

The Heltzel Steel Form and Iron Co.

The Heltzel Steel Form and Iron Co. will occupy Booth AR-12, where they will exhibit a complete line of concrete road building equipment, including a 3-compartment portable storage bin equipped with a 3-compartment weighing batcher which has a very novel arrangement for operating the charging and discharge gates. The automatic springless dial scale will be used in connection with this installation; a complete line of Steel Forms for the construction of concrete roads, city streets, curb and gutter and sidewalk.

The latest improved Flexible Joint Machine will be displayed under actual working conditions. There will also be numerous small tools, such as Alu-



Heltzel storage bin.

minum Jointing Tools, Straight Edges, Floats, etc.

The following representatives will attend the exhibition: J. N. Heltzel, President & Treasurer; J. Wm. Heltzel, Ass't General Manager; B. M. Clark,

Sales Manager; R. R. McBride, Chief Engineer; W. A. Flick, Traffic Manager; O. W. Davis and T. M. Bentley, Field Representatives.

Wiard Plow Co.

The Wiard Plow Co., Batavia, N. Y., will show a full line of contractors' plows, from the smallest to the largest size, a scarifier, grade ripper and scraper. The exhibit will occupy space A-64-A.

C. S. Johnson Co.

A new Multiple Material Weigh Batcher designed especially for paving contractors will be exhibited by the C. S. Johnson Company of Champaign, Illinois, in Space No. 24 in the Arena. The batcher is constructed to handle



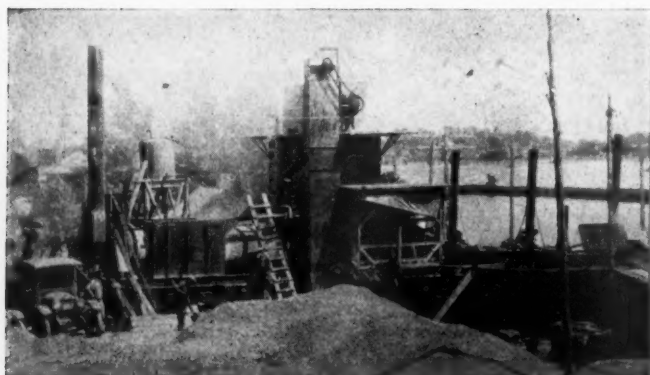
three aggregates and is divided into three compartments, the weight of each compartment being controlled by a separate beam which eliminates any adjustment after the beams are once set.

The exhibit will also include the improved Bantam Weigh Batcher, a new Bulk Cement Handling Cart and standard Single Material Weigh Batcher for sand and stone.

Messrs. C. S. Johnson, J. C. McLean and K. H. Melzer will represent the Company at the Show.

The F. D. Cummer & Son Co.

The F. D. Cummer & Son Co., Cleveland, O., manufacturers of asphalt plants and driers, will have leaflets, catalogs and photographs describing their equipment.



A Cummer asphalt plant.

The Barrett Company

The central part of the Barrett exhibit this year as has been the case for the past several Road Shows, will be the big Tarvia truck from which sweet cider will be served to all comers. Doubtless this feature will be as popular as ever this year.



Above and at left, Hercules rollers.

The pre-mixed tar macadam "Tarvialithic" will be featured in the exhibit. Samples of the various sized mixtures and sections of actual pavements will be on display.

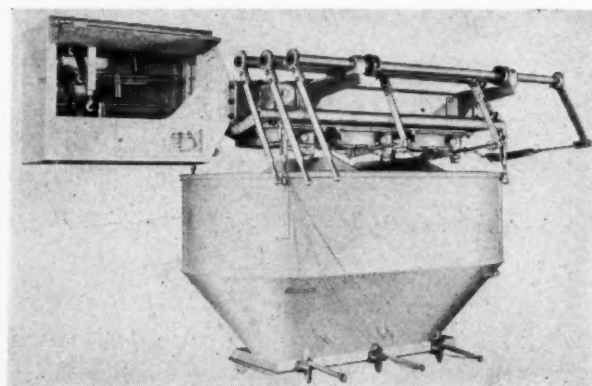
A new and radically different concrete joint and crack filler called Plastic Tarvia-XC has been perfected by the Barrett Research Organization and will be demonstrated at the Road Show. This material has been thoroughly tried out in various parts of the country.

As usual, The Barrett Company will be represented at the Road Show by Tarvia executives and engineers from all parts of the country.

The Trackson Co.

Exhibits of the Trackson Co., Milwaukee, Wisc., will be located in space A-28. The equipment will include the new Trackson G H Crawler, the latest development in the company's line of tractor equipment; the new Trackson High Shovel; Trackson crawler wheels, and the L H crawler unit with Trackson hoist.

L. E. Dauer, sales manager; W. H. Stiemke, general manager, and other representatives will be in attendance.



The Johnson scalebatcher.

Austin-Western Road Machinery Co.

The Austin Western Road Machinery Co. exhibit in spaces A-43 and A-25 will include the following items:

Austin 6-cylinder 12½-25 Dual Drive Motor Grader equipped with front scarifier, pneumatic tires, electric starting and lighting system and special blade for oil mix work.

Austin Model 20 Dual Drive Motor Grader with leaning front wheels, electric lighting system and Super-Service blade for gravel road maintenance.

Austin 10-ton Autocrat Roller with pneumatic scarifier, electric starter, power steering and wheel sprinkling system.

Austin 7-ton Cadet Roller with pneumatic scarifier.

Austin Mammoth Senior Leaning Wheel Grader with front scarifier and back sloper.

Austin Contractor's Special Elevating Grader with engine driven carrier.

Western "Earthmover" Elevating Grader with engine driven carrier.

Western 5-yard Direct Hitch Crawler Dump Wagon with automatic spring wind-up.

Western Tandem Drive Motor Maintainer with front scarifier.

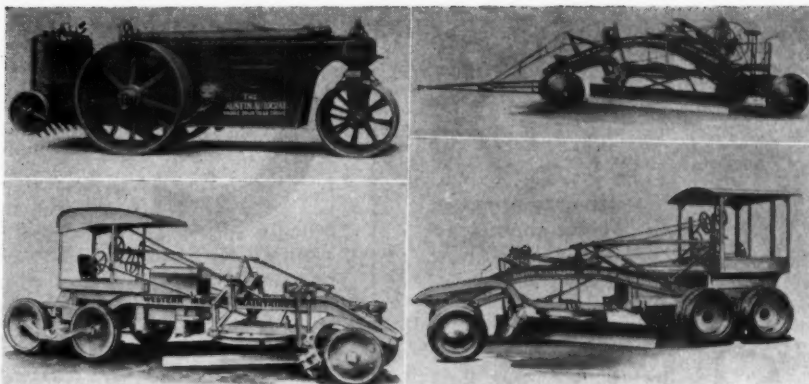
The White Company

Three trucks especially designed and engineered for construction and maintenance work and for freight and long distance hauling will be exhibited by the White Company at the Road Show. The exhibit, in Space B-16, in the north exhibition building will include:

White Model 64, a six-cylinder chassis of 157 inch wheelbase, for heavy duty dump trucks and for tractor-trailer operations. This is an extremely powerful heavy duty chassis with a 100-horsepower engine and a four-speed heavy duty type White designed transmission with White clutch.

White Model 63 with Wood hoist

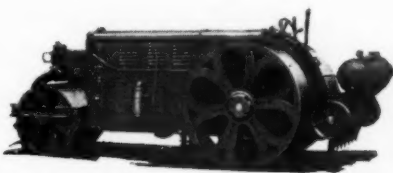
Top and right: White model 63 dump truck. Left, 63 dump truck and trailers. Part of the line of White motor trucks for construction purposes.



Austin-Western rollers, graders and maintainers will be shown.

and dump body, having two swinging partitions to carry dry batches. It is powered with a six-cylinder engine with a piston displacement of 396 inches. A range of five ratios is available to meet any type of hauling requirement.

White Model 212 will be equipped with a No. 2 Heil hoist and two-yard dump body, suitable for use by State and County highway departments for



Huber Motor Roller

maintenance work. This model is a four-cylinder chassis particularly adapted to work where a fast, small capacity truck is needed.

The White Company will be represented by Saunders Jones, vice president and assistant to the president, George F. Russell, Vice President and Sales Manager, W. A. Maynard, Sales Promotion Manager, H. P. Starbird, in charge of exhibit, who will be assisted

by J. N. Bauman, R. J. Logan, C. I. Fraley, R. E. Laisy, R. S. Laphan, G. R. Bryan and R. J. Soulen.

Huber Mfg. Co.

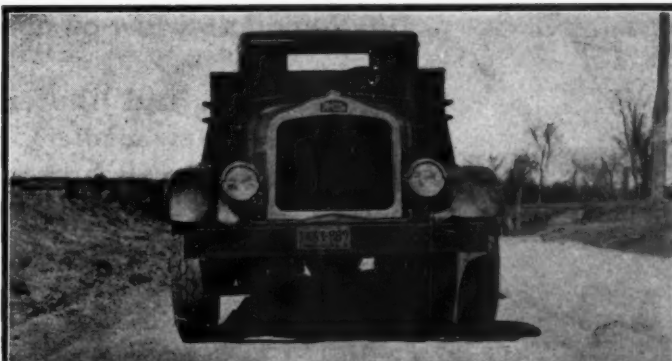
The Huber Mfg. Co., Marion, O., will exhibit in spaces A-32 and A-41. They will show a 5-ton Huber roller with scarifier and a 10-ton with scarifier. They will show for the first time, a new 8-ton four cylinder motor roller. This roller gives a line-up of Huber rollers of the following sizes in the three wheel type roller: 5, 6, 7, 8, 9, 10, and 12-ton. The design of the new 8-ton is along the lines of the present type machines. It is equipped with a Waukesha motor, which is standard equipment on all Hubers, and it has the built-in differential with double spur gear drive—an outstanding feature of Huber rollers.

Central Iron & Steel Co.

The Central Iron & Steel Co., Harrisburg, Pa., will have an exhibit at the Road Show. Their "Knobby" Non-Skid Floor Plates, Traffic Treads, etc.,

are being extensively used in all characters of road construction and all kinds of road building machinery, and they will have exhibits of the various plates they make and their application.

Mr. Irons, President of the Company, together with his technical road staff, will be in attendance.



CLETRAC

?????

 To be announced
at the Road Show

**CLETRAC
TWENTY**
**CLETRAC
FORTY-
THIRTY**

**CLETRAC
FORTY**
**CLETRAC
EIGHTY-SIXTY**

At the
**ROAD
SHOW**

you will find the Cletrac Exhibit in Building "A" in adjoining spaces 24 and 44, January 12 to 16, at St. Louis.

C L E C R A W L

NEVER before in a single tractor line has there been offered so extensive an array of industrial power units as you find in the 1931 Cletrac line-up. With a power range up to a maximum delivery of 80 h.p. in the big 80-60, the line meets fully every power need in road and general contract work. Up-to-the-minute in every mechanical detail — rugged as tough steels and sound design can make them — dependably powered with the most modern of tractor motors — these Cletracs offer unquestionably the greatest values from which to select your 1931 tractor equipment.

- Automatic lubrication on all models
- Exclusive, patented planetary gear steering
- Remarkably low oil and gas consumption

See the Cletrac full line exhibit at the ROAD SHOW. The new smaller Cletrac with its marked advantages for small horsepower jobs — the new Cletrac "40-30" with its trim lines and superb performance — the Cletrac "20" — the old, trusty "40" — the incomparable "80-60" — all of these will be there to give you at first hand a complete picture of how Cletrac can serve you.

*Literature on any or all models
will be mailed on request.*

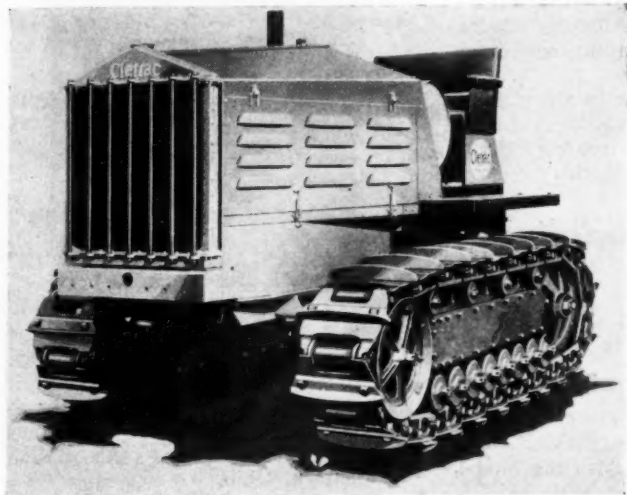
The Cleveland Tractor Company
19322 Euclid Avenue Cleveland, Ohio

Cleveland Tractor Co.

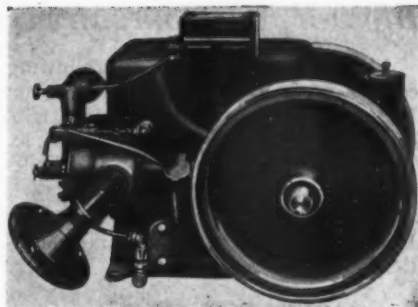
The Cleveland Tractor Co., Cleveland, Ohio, will exhibit in spaces 24 and 44, which are adjoining, giving a larger space than hitherto. The exhibit will consist of a complete line of Cle-

way engineers, and J. D. Fletcher, now head of the Export Department, will also attend with a staff to meet foreign visitors.

The Caterpillar Tractor Co. will show the following equipment:



Left: The 80-60 Cletrac, manufactured by the Cleveland Tractor Co. One of the Road Show exhibits.



Above, right: The Hercules industrial engine, and below, one of the Hercules body types for dump trucks.

trac crawler tractors, composed of models 15, 20, 40-30—40 and 80-60 Cletracs. The entire list of officials and department heads at the factory will attend, as well as the entire force of field salesmen for the whole United States.

Humboldt Mfg. Co.

The Humboldt Mfg. Co., 2014 Nebraska Ave., Chicago, Ill., will exhibit in booth B-136 road materials testing equipment, such as cement molds, cement fineness shaker, cement consistency apparatus, specific gravity apparatus, setting time tester, testing sieves and screens, asphalt ductility machine, asphalt penetrometer, asphalt viscosimeter, melting point apparatus, shear test machine for asphaltic mixtures, grease consistometer and grease worker.

One of the outstanding pieces of apparatus that will be shown is the "Eureka Testing Outfit," which was designed by Prof. W. M. Dunagan of Iowa State College for use in performing the following tests: 1. Specific Gravity of fine and coarse aggregates; 2. Free moisture or absorption; 3. Silt determination, and 4. Analysis of the constituents of fresh concrete.

The exhibit will be in charge of A. F. Andt.

"Caterpillar" Has Biggest Show Exhibit

The honor of having the largest individual exhibit goes to the Caterpillar Tractor Co., of Peoria, Ill. Space A-26 in Building "A," 74'x 64' has been assigned to "Caterpillar."

The "Caterpillar" exhibit will be in charge of A. E. Loder, recently promoted to assist O. L. Starr, Vice President in Charge of Manufacturing. Mr. Loder will be assisted by eight "Caterpillar" district representatives on the show floor. Charles Spears will attend with his staff of construction and high-

Fifteen Motor Patrol, Fifteen Trailer Patrol, Twenty Planer, Thirty Leaning Wheel Grader, Sixty Leaning Wheel Grader, Sixty Elevating Grader mounting a "Caterpillar" Twenty engine, Super Special Grader, Ten Grader, Sixty "Caterpillar" with Snow Plow; Thirty, Twenty, Fifteen and Ten "Caterpillars"; Ten High Clearance "Caterpillar," Fifteen "Caterpillar" with side seat, Twenty "Caterpillar" with side seat.

The Caterpillar Tractor Co. will be holding on January 12-24 at Peoria, Ill., its All-"Caterpillar" Exposition for its dealers and the 50 manufacturers building new equipment to team with "Caterpillar" power. Some 150 new models, many never shown the public before, will be on exhibit with company representatives to explain their operation.

The "Caterpillar" organization will

be prepared to accompany parties to the "Caterpillar" plant and All-"Caterpillar" Equipment Show when they leave the Road Show at St. Louis.

Moritz-Bennett Corp.

The Moritz-Bennett Corporation, Effingham, Ill., will exhibit in Booth A-104 a full size Moritz Shoulder Finishing Machine. In addition, they will have moving pictures of the machine in operation.

Those who will be in attendance are as follows: E. A. Moritz, President; W. M. Bennett, Vice-Pres. and Sales Manager; C. J. Moritz, Vice-Pres. and Treasurer; J. S. Raleigh, Chief Engineer.

Hercules Products, Inc.

Hercules Products, Inc., Evansville, Ind., will occupy spaces B-11 and B-86. In B-11 they will exhibit a line of dump bodies for motor trucks and in B-86 a line of industrial and farm engines. Both of these products are new and of special interest.



Caterpillar leaning wheel grader.

Blaw-Knox Company

Blaw-Knox will exhibit the following equipment: (1) Portable Bulk Cement Plant for road contractors, 110 barrel capacity, equipped with 1,000 lb. Blaw-Knox Cement Batchers 1931 design.

(2) The Cementank, a new Blaw-Knox development for the transportation of bulk cement.

(3) The seven yard Blaw-Knox Wagon Grader equipped with crawler tracks for fast operation.

(4) The new 8 inch base Blaw-Knox Road Form will be exhibited.

(5) Blaw-Knox Weighing Batcher

(6) The Blaw-Knox Agitator Truck Body.



The Shunk Camel Dump.

(7) The Ord Finishing Machine. This machine will be shown in operation on Blaw-Knox Road Forms.

(8) Fifty-one ton Blaw-Knox Weighing Batchers equipped with a Blaw-Knox double weighing batcher.

(9) Popular types of Blaw-Knox Clamshell Buckets and Dragline Buckets will be on display.

(10) Blaw-Knox Street and Sidewalk Forms.

Shunk Mfg. Company

The Shunk Mfg. Co., Bucyrus, Ohio, will exhibit in Booth A-58, the new Camel automatic gravity tractor dump, which is adaptable for use in earth moving operations and can be converted into a bulldozer; the Success twin dual road maintainer; and Shunk traffic lane markers. The exhibit will be in charge of C. H. Richardson and C. H. Fegley, factory representatives.

Toncan Culvert Manufacturers' Asso.

The Toncan Culvert Mfrs. Association exhibit, in Booths A-81 and 87, will feature corrugated metal culverts of Toncan Iron. J. T. Hay, Manager of the Toncan Culvert Manufacturers' Association, will be in charge of the booth, L. M. Berry, Advertising Manager of the Association.

General Wheelbarrow Co.

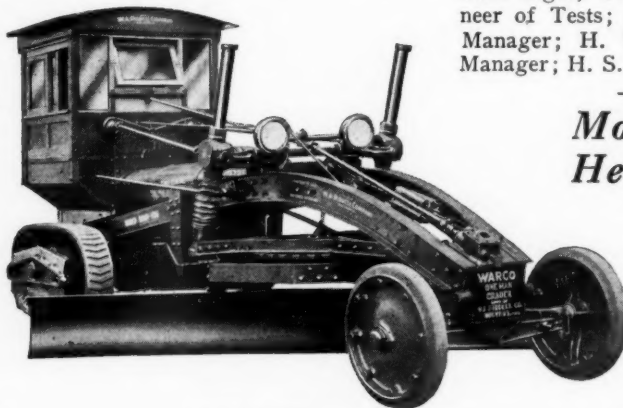
General Wheelbarrow Company, Cleveland, O., will have their exhibit this year in booth B-116. The exhibit will be devoted entirely to "Empire" Grader Blades, showing finished blades in various lengths, and the new state standard punching.

The following will be in attendance: W. A. Gordon, sales manager; J. W. Cole, southern sales representative; J. M. Rorimer, vice president.

Warco Road Building Machinery

The W. A. Riddell Company, of Bucyrus, Ohio, exhibit in Space A-23, in Exhibition Hall "A."

Among machines included will be the Warco Model "E" Power Grader with "TGA" Rear-Type crawlers, and Bulldozer attachment. Also the Model "10-R" Rear Control power grader with Model "TR" Rear-Type rubber crawlers. This will be the first exhibition of the newly developed Warco Rubber Crawlers. This will be equipped with an enclosed cab and with



Riddell One-man Grader.

battery, generator, lights and snow plow attachment.

The exhibit will be directly in charge of N. E. Jersey, Road Machinery Sales Manager. Others will include W. A. Riddell, president; G. M. Schmidt, general manager; G. D. Shaeffer, grader engineering department; C. A. Henneuse, crawler engineering department, and J. E. Patterson, scoop engineering department.

Armco Exhibits Latest Drainage Developments

Multiple Paved Invert Pipe the most recent development in drains of



Armco Paved Invert Pipe.

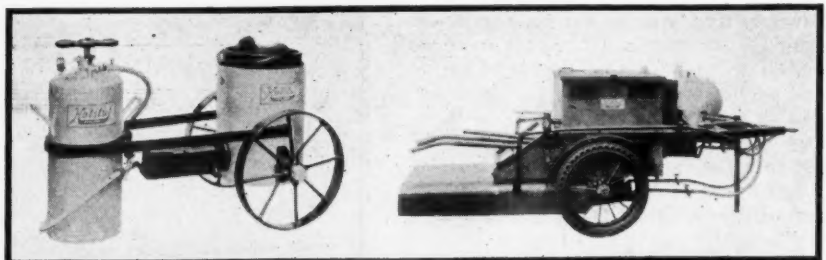
balanced design and the latest application of perforated iron pipe to highway subdrainage, present the main attractions of the exhibit of the Armco Culvert Manufacturers Association, Middletown, Ohio.

This display, featuring subjects of timely interest to road builders, will be found in space A-119. The following representatives of the Armco Culvert Manufacturers Association are in attendance: S. R. Ives, Vice President & Gen. Mgr.; George E. Shafer, Engineer of Tests; M. C. Noble, Regional Manager; H. W. Gregory, Regional Manager; H. S. Claybaugh.

Mohawk Asphalt Heater Company

Mohawk Asphalt Heater Company, Schenectady, N. Y., will exhibit Hotstuf asphalt heaters, Mohawk Hi-Speed trailer tool boxes, Mohawk oil burning torches and concrete heating equipment at the Road Show.

New this year will be the Hotstuf Three-in-One Combination Tool, Asphalt and Surface Heater, which, as its name implies, is three equipments mounted on a single chassis. A heavy channel section chassis, equipped with semi elliptical springs and rubber tires, roller bearing wheels, carries a tool heating compartment which will handle sixteen paving tools and is said to deliver hot tools in five minutes.



Mohawk Lead Melting Furnace at left: Combination Tool and Surface Heater at right.

Pioneer Gravel Equipment Mfg. Co.

The Pioneer Gravel Equipment Manufacturing Company of Minneapolis, Minnesota, will display their 1931 Model 300-W Washing, Crushing, Screening and Loading Plant in space No. AR-8.

A Double Drum Dragline Unit specially designed for attachment to a Caterpillar 60 Tractor will also be exhibited.

Headley Emulsified Products Co.

The Headley Emulsified Products Co., Philadelphia, Pa., will exhibit in booth B-121 literature and photographs.

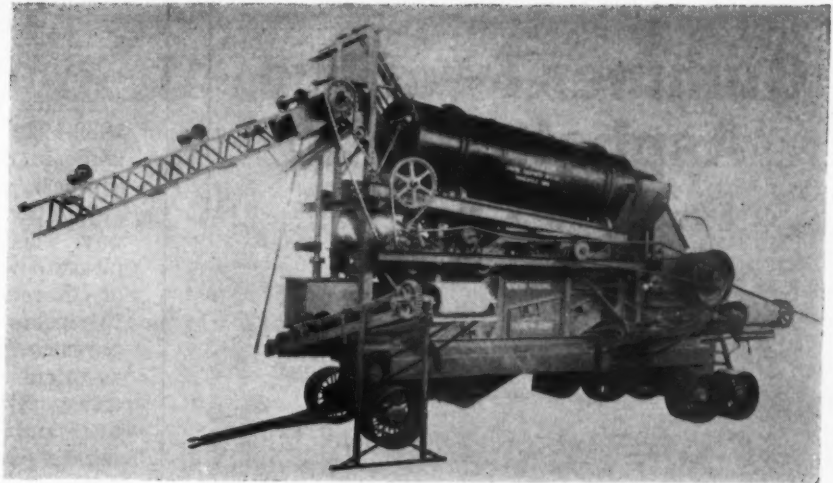
National Paving Brick Mfrs. Ass'n.

The National Paving Brick Mfrs. Assn., Washington, D. C., will have photographs; literature; moving pictures; a model showing a brick paved city street and intersection and a brick paved rural highway under construction; there will also be a model and photographs of the experimental brick pavement on metal base recently constructed.

Foote Bros. Gear and Machine Co.

Foote Bros. Gear and Machine Co., Chicago, Ill., will have on display in their booths, A-10 and A-21, a representative line of Bates Tractors and Stockland Graders in various sizes and with their auxiliary equipment.

The following men will be in attendance at the booths: W. C. Davis, President; H. H. Bates, Vice-President and



Pioneer 300-W Washing Plant.

Sales Manager; W. O. Bates, Jr., Promotion Manager; F. P. Callaghan, Vice-President; W. A. Barr, Vice-President; J. P. O'Hare, Asst. Sales Manager, and various other local and state representatives from other territories.

Galion Exhibit One of Largest

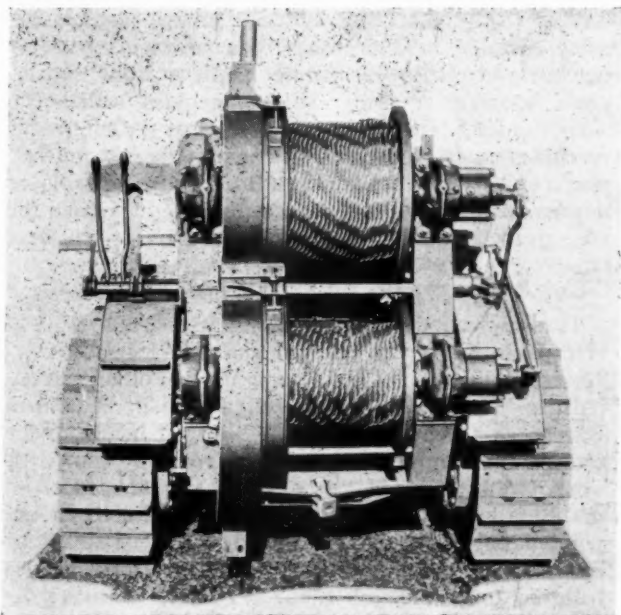
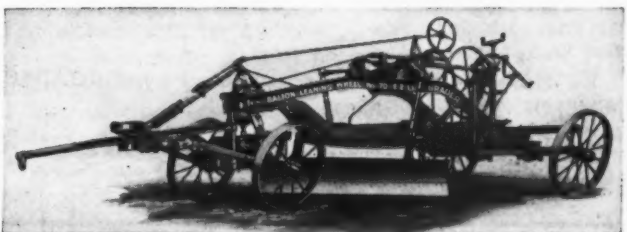
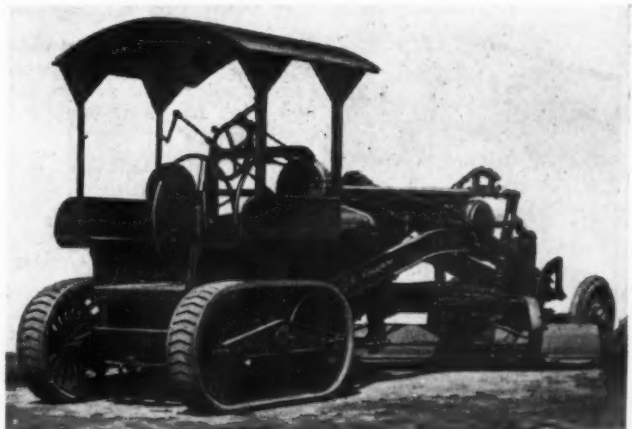
The Galion Iron Works and Mfg. Company of Galion, Ohio, will exhibit the following equipment at the Road Show: No. 12 Heavy Duty E-Z Lift

Leaning Wheel Grader, No. 70 E-Z Lift Leaning Wheel Grader, No. 8 Multiple Blade Maintainer, 10-Ton Master Roller with Scarifier, 7-Ton Little Master Roller with Scarifier, Stone Spreader, McCormick-Deering Motor Patrol Grader with Sure-Trac Rubber Crawlers, cab and independently operated Scarifier.

Many new features of operation and construction in Galion Equipment will be of interest. Three new machines, developed during the past year, which will be exhibited, are illustrated herewith.

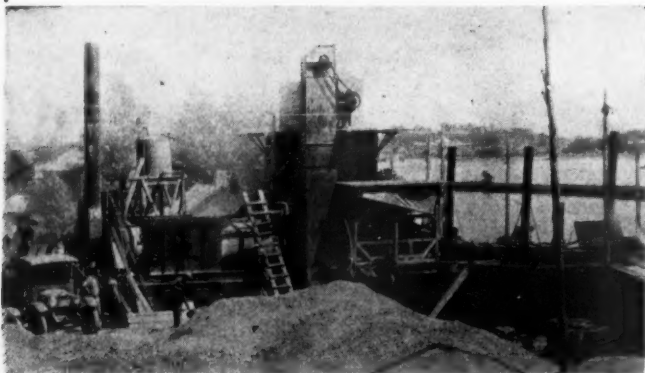
At right: Galion equipment; top, the No. 8 multiple blade maintainer; middle, motor patrol grader; bottom, No. 70 leaning wheel grader.

Below: Pioneer dragline drum unit on caterpillar tractor.



Cummer Two-Fire Asphalt Plant

(Patents Pending)



Large Capacity on Black Base

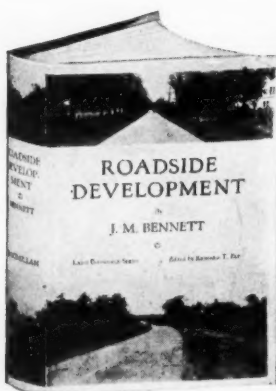
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ALL SIZES; ALL STYLES

The F. D. Cummer & Son Co.
CLEVELAND, OHIO

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By J. M. Bennett

Based on 10 years' actual experience and supervision of work costing millions of dollars, this new book by J. M. Bennett is invaluable to

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O. K. Please send me postage prepaid one copy of **ROADSIDE DEVELOPMENT** by Bennett.

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San Francisco Boulevard Construction

In that portion of his annual report for the year 1929-1930 which refers to the construction of boulevards in San Francisco, M. M. O'Shaughnessy, city engineer, said:

"On all of the new boulevards (except Great Highway, where the traffic is confined almost entirely to pleasure vehicles) the pavement consists of 8 inches of concrete base, 1½ inches of asphaltic binder, and 1½ inches of asphaltic concrete wearing surface. This pavement is laid where the subgrade is well compacted, as in cuts or on foundation that has already carried traffic. All new fills are sprinkled and rolled, but on them and on other places liable to settlement a temporary pavement is laid until such time as the subgrade shall have become thoroughly compacted. This temporary pavement consists of 8 inches of water-bound macadam with a 2-inch wearing surface of either asphaltic concrete, emulsified asphalt, or oiled macadam. It was originally planned to set this so that it would constitute a foundation for the future, permanent pavement, tapering off the surface from the present permanent to present temporary pavement in 50 to 100 feet, but the consequent inequality of grade was objectionable to motorists traveling at high speed. Therefore it was decided to set all temporary pavement at the same grade as permanent pavement. When it becomes advisable to replace the temporary pavement with permanent pavement, the entire water-bound macadam base will necessarily be removed.

"For concrete base the mix is approximately one part of cement to 5.5 parts of aggregate. With careful attention by the inspector this mix has been giving concrete showing well over 3000 pounds strength on 7-day test and ranging around 5000 pounds on 28-day test.

"So far as possible the entire construction is by improved mechanical methods and the results are highly satisfactory. Preparation of subgrade has employed power shovels, trucks, caterpillar drawn scrapers, bulldozers and subgrader machines. No height of subgrade above ideal depth has been tolerated, and as the quantities of concrete actually placed check almost exactly with the estimated amounts, it is evident that the grading has been done by the machines exactly to the neat lines indicated in the plans. This same enviable exactitude has been attained by use of machines in placing the binder and the asphaltic concrete wearing surface. These machines utilize the same header boards (often of steel) that the subgrader machines used. The specifications provide that finished surface shall be true and uniform, with no rolls or depressions in any 10 feet exceeding ¼ inch from the true grade and cross section."

A County Smoke Department

Hudson county, New Jersey, across the Hudson river from New York City and including Jersey City, Hoboken, Bayonne, Weehawken and ten other municipalities, has recently organized a Smoke Abatement Bureau as a department of the board of health of the county and appropriated \$40,000 for the first year's work. William G. Christy, mechanical engineer of the Board of Education of St. Louis, has been appointed engineer in charge, and will be assisted by a deputy engineer and six smoke inspectors. This is believed to be the first county to set up a smoke department.

Trends in Public Health Engineering

By Isador W. Mendelsohn

Training of Water and Sewage Plant Operators

SIGNIFICANT developments have taken place in the past ten years in the United States, which have had and will continue to have a great influence on the training of water and sewage plant operators. In chronological order, these are: (I) The establishment of schools for water and sewage plant operators, also the formation of local sections of national water and sewage works associations; (II) programs for training plant operators now prevailing in North Carolina, Ohio, and other states; (III) the Report on Practical Operation of Sewage Works of a committee of the American Society of Civil Engineers; (IV) the appointment of a fact finding committee on the economic condition of water works personnel by the American Water Works Association; and (V) the construction of many large water purification and sewage treatment plants.

I. Thirteen years ago the Texas State Board of Health, in cooperation with the state university, established a school to offer intensive training, primarily for water works operators, in the fundamentals of water purification plant operation by means of lectures, demonstrations, individual laboratory work, and discussion. The example of Texas has been followed by other states, such as Iowa and West Virginia, Kansas, with courses lasting for one to two weeks. Similar schools for sewage plant operators have been established by states, such as New Jersey, and lately by New York. The benefits from these schools have been supplemented by the formation of numerous local sections of the American Water Works Association and the Federation of Sewage Works Associations, largely through the efforts of the state departments of health and universities. At present almost every state or group of states has such organizations. According to H. E. Miller, the North Carolina Section of the American Water Works Association has stimulated the operators and demonstrated the advantage of practical application of scientific principles in routine operation.

II. After a survey of water purification plants in North Carolina in 1921 by the State Board of Health, Mr. Miller, chief sanitary engineer, developed a policy for assisting towns of less than 10,000 population in securing and training operating personnel for small water purification and sewage treatment works. The essential features of this program are: (1) Obtaining the good will of municipal officials by helping them solve their immediate problems; (2) assigning a sanitary engineer of the board for a week or two to work the plant with the operator, donning overalls and taking apart every piece of equipment, scrubbing out coagulation basins, taking the sand and gravel from the filter and examining the underdrainage system, performing other plant chores and making simple laboratory tests; (3) following up this assistance by frequent visits where necessary, and making routine inspections of each plant at least once a month; (4) informing municipal officials of the necessity of tech-

nical plant supervision and the benefits accruing to the town by having an operator with engineering training who would be able to serve as operator not only of the water works but also of the sewage disposal plant, as milk inspector where the town had passed the standard milk ordinance, as assistant to the superintendent of water works, city engineer, or city manager in making accurate maps of the water and sewerage systems and other engineering work, and as superintendent of the water works; (5) furnishing lists of qualified technically trained men to the municipal officials, and keeping informed of their activities after placement to insure satisfactory work; (6) obtaining monthly reports from operators regarding plant operation, cost data, and chemical and bacteriological laboratory results; (7) detailing a sanitary engineer to a plant to investigate and remedy any special problem; (8) assisting technical operators in established plants in securing a better position when an opening develops in another town; (9) helping the North Carolina Section of the American Water Works Association; and (10) cooperating with both state universities in supplying qualified plant personnel by establishing and maintaining sanitary engineering courses in their curricula.

Among the beneficial results of this policy are: (1) 28 of the 68 small-town water purification plants, 12 of the 15 plants in large cities, and 3 of the 5 institutional plants, are operated by technically trained men, and one town of 1,147 population has a technical operator who is superintendent of water works, looks after the sewerage system, and operates the disposal plant; (2) a general increase has occurred in plant efficiency and a general decrease in the total cost of water filtration; (3) more complete and accurate plant records are being kept; and (4) the demand of municipalities for technically trained operators has increased.

In Ohio similar results are obtained by the State Department of Health with a different policy, the essential features of which, according to Thomas R. Lathrop, assistant sanitary engineer, are: (1) employment by almost all the large cities of technically trained men for water purification works, with plant performance conforming to standard practice throughout the United States; (2) efforts by the department to maintain a similar standard in the small water works by impressing the municipal officials with the importance of a water which is free from harmful bacteria; (3) training operating personnel at the small plants in a few instances by assigning sanitary engineers of the department, (4) in general, training the small-plant operators by arranging with the town officials for the employment of a part time qualified filtration plant superintendent from a nearby city, who acts in a supervisory capacity, and, if necessary, spends considerable time in instructing the new operator. The latter may spend a week or two at the supervisor's plant, learning the details of plant operation and the procedure in making routine bacteriological and chemical tests. The small plant generally has a laboratory, the media being supplied by the supervisor. The latter makes a weekly inspection of the plant and bacterio-

logical and chemical analyses, and reports on the plant operation to the State Department of Health. The supervisor regularly informs the town officials concerning the operation of the plant. This policy has not only produced satisfactory plant operation of small water works, but has resulted in additional experience for the supervisors and extra remuneration, tending to retain them in the water works field.

In West Virginia, Tisdale states that both the North Carolina and the Ohio plans are being used successfully in training water works operators.

III. The final report of the Committee on Practical Operation of Sewage Works of the Sanitary Engineering Division of the American Society of Civil Engineers, presented in July, 1930, stated that one of the two outstanding reasons for unsatisfactory operation of sewage treatment plants is the need of well trained and efficient personnel, and recommended that superintendents of sewage works be placed in three grades according to education and experience; Grade A, to be for graduates of engineering schools with at least 5 years' experience in problems relating to sewage treatment, able to operate large plants serving over 100,000 people and receiving 3 to 5 times the wage equivalent for common labor; Grade B, for at least high school graduates with additional training in chemistry and engineering and at least 5 years' experience in problems relating to sewage treatment, able to operate plants serving 50,000 to 100,000 people, and receiving 2 to 3 times the wage equivalent for laborers; and Grade C, for those with an elementary school education and training equivalent to that of a skilled mechanic or skilled laborer, able to operate plants serving less than 50,000 people, and receiving 1 to 2 times the wage equivalent for common labor. Grade C operators are to be supervised by sanitary engineers or chemists with Grade B or A qualifications. It is quite likely that, as this report is studied further by consulting and other sanitary engineers, its recommendations will gradually be placed before responsible municipal officials, who will be influenced thereby in future appointments of sewage plant operators.

IV. Faced with the pressing problems of (1) holding competent water works men now employed in the art of water purification, (2) attracting to this field those mentally and technically equipped to efficiently design, construct, manage, or operate water supply systems, and (3) safeguarding the property, health, and lives of those dependent upon community water supply, the American Water Works Association at its last meeting considered the following program to improve the economic conditions of water works men:

(1) Determine the necessary qualifications for various positions in the water works field, and the market rate of compensation for persons possessing such qualifications in the locality to be employed.

(2) Educate the public to support qualified men at the right salaries for various water works positions.

(3) Each state through an official body (probably the department of health) to pass upon the fitness of those to be employed, and licensing qualified personnel for definite positions. (In New Jersey, sewage plant operators have been licensed for several years through the State Department of Health).

(4) The American Water Works Association to collect data on compensation and basis of selection for employment, and publishing these data; also to aid by an educational campaign in securing the adoption of suitable standards for the personnel.

The Association appointed a committee to obtain

data on the economic condition of water works personnel, as mentioned in item (4).

V. During the past ten years a considerable number of water purification plants have been installed at such large cities as St. Louis, Kansas City, Detroit, Cleveland, Washington and Buffalo, and sewage treatment plants at such cities as Chicago, Cleveland, and Milwaukee. In addition, there have been a considerable number of plants for cities of less than 250,000 population. These have necessitated employment of capable, technically trained operators, with a scale of remuneration commensurate with the responsibility involved.

The trend toward improved operation of water and sewage works is evident and inevitable. The next decade should witness tremendous benefits accruing therefrom, largely through raising the qualification and improving the economic status of plant operators. To bring this about most effectively, it is desirable that the regularly constituted governmental bodies and the professional societies cooperate to the fullest possible extent. State departments of health are charged with the responsibility of safeguarding the public health, which includes insuring a supply of water free from harmful bacteria, and the proper disposal of sewage. It is within their province to see that plants are well operated, by arranging for the training of the plant personnel and securing the employment of technically trained men by the cities. On the other hand, the water works and sewage works associations have been formed primarily to raise the standards of their professions and improve the welfare of those engaged in them, and it is entirely fitting that they set the standards of training for operators of various size plants, assemble data concerning fair compensation for such operators, and educate the public to demand competent men and remunerate them accordingly.

Trenching by Hand vs. Machinery in Topeka

The city officials of Topeka received bids on November 12th last for constructing a storm sewer, to cost between \$65,000 and \$70,000. Because of the agitation for using hand work instead of machinery as far as possible, to give work to the unemployed, contractors were asked to bid on both, hand work to be on the basis of excavating the full necessary width of the ditch to a depth of 8 feet by hand, and to backfill all of the ditch by hand.

The bidders were apparently uncertain as to what class of labor the city might request them to use; besides which, so little hand labor has been used of late years that there is much uncertainty as to its cost. It was difficult to get all the contractors to bid on hand work; in fact, some refused to do so except on a cost-plus basis.

Of the seven bidders, the one lowest on excavation (which was bid separate from furnishing and laying the sewer) bid \$8,377 by machine and \$12,373 by hand. The least difference was between the bids of \$8,941 and \$10,934 for machine and hand respectively; the greatest difference was between \$13,895 and \$25,438. The averages of all bids were \$12,709 and \$20,169; the average for hand labor being 59% greater than that for machine work. The difference, however, was but about 10% on the basis of the entire cost.

Topeka decided to accept one of the bids on the basis of using machinery.

A General Review of Paving During 1930

(Continued from page 21)

aided in producing a better grade of materials and greater uniformity of product.

Proportioning of fine and coarse aggregate, and in some cases of cement, by weight has been adopted extensively and is now considered the best standard practice.

Coarse aggregates are being proportioned and measured in separate sizes. New Jersey has been using two sizes, and in 1931 New York also will adopt this method; while in some places three sizes are proportioned separately and the percentage of each so determined as to produce greatest density.

Mixing water is being measured accurately, allowance being made for moisture in the aggregate, so that uniformity is secured in total quantity used.

The 10-foot width of strip has been adopted generally, which is of material assistance in traffic control.

There has been a tightening of requirements as to tolerance in surface irregularities of the entire surface, including the joints.

Strengths are from 25 to 50 per cent higher at all ages than those generally obtained a few years ago, which enables the opening of the pavement to traffic at the end of a week under good weather conditions, instead of the former two to three weeks, and also obviates the necessity of blocking off traffic from repairs to cuts for so long a time as formerly.

The use of machine finishers has increased greatly during the year and hand finishing is rapidly becoming obsolete.

The state of Pennsylvania uses a form for tabulating the number of working hours possible each day and those availed of, the batches of concrete actually mixed on each job, and a comparison with the number of batches which it is possible to turn out in the working hours, in order to compute the efficiency of work on each job, as a means of speeding up the work.

Granite Block Pavement

The amount of this pavement laid in 1930 has shown a substantial increase over that laid in 1929, notwithstanding the fact that it is more generally used in cities than on state and county highways. A good deal of the increase has been due to the extension of the use of the shallower blocks on bridges and viaducts and the approaches to these structures. A notable example is the new "Express Highway," an elevated steel structure up the west side of Manhattan Borough of New York City. Here a 4-inch depth block was used, with an asphalt mastic filler in the joints.

More attention has been given to the cutting of the blocks and to improving the joint filler. For the joint filler (which is generally an asphalt mastic), where the traffic is extra heavy and proceeds in well defined lines an asphalt having a penetration of 50 to 60 at 77 degrees F. has been

used with success, in place of the commonly used one having a penetration of 60 to 70 at 77 degrees F. To this is added a dry, hot sand up to 45 to 50 per cent by volume of the total mixture. This has given good results if the materials are kept hot and the tools for squeegeeing it off the surface and into the joints are kept hot and changed often enough. The object is to get all of the mastic possible off of the surface and into the joints, as a surplus on the surface detracts from the smoothness of the pavement and is apt to prove a nuisance in warm weather until traffic wears it off.

The outlook is favorable for a good increase in granite block construction during the coming year.

School for New York Sewage Plant Operators

A school for sewage works operators will be conducted at Union College, Schenectady, January 26 to 31. Although open to all operators in the state, registration will be limited to twenty so that individual instruction may be assured. A registration fee of \$5 is charged to cover cost of laboratory materials, bus transportation on inspection trips, etc.

There will be lectures by E. B. Phelps, professor of Sanitary Science at Columbia University, director of the school, on "Principles of Sewage Disposal," "Preliminary Treatment of Sewage," and "Oxidation Treatment of Sewage"; by W. C. Taylor, associate professor of civil engineering at Union College, on "General Sanitation"; by Morris M. Cohn, sanitary engineer of the city of Schenectady, on "Schenectady Sewage Treatment Works"; by C. R. Cox, asst. sanitary engineer, State Dept. of Health, on "Chlorination of Sewage"; and by C. A. Holmquist, director Div. of Sanitation, State Dept. of Health, on "State Control of Plants and Relation to Local Operators."

There will also be laboratory instruction by L. M. Wachter, chemist Div. of Laboratories and Research, State Dept. of Health, on bacteriology and chemistry of sewage disposal.



Four-lane concrete road in Westchester Co., New York.

Activated Sludge Plant Using Mechanical Aeration

(Continued from page 27)

water to within 18 inches of the bottom of the tank. A metal apron, curved to conform with the path of the paddles, extends from the baffle wall, underneath the rotating mechanism about two-thirds of the way to the surface of the water.

Upon starting up the paddles the sewage is drawn over a weir located at the top of the baffle wall and forced across the tank on the surface at a velocity of approximately 2.5 ft. per second. Upon reaching the opposite side of the tank it meets a deflector, which directs it downward. It then sweeps across the bottom of the tank and rises up behind the baffle wall to again meet the paddles. The spiral flow so created begins the moment the sewage enters the tank and does not cease until it leaves it.

The agitator is supported on brackets attached to 6-inch wide concrete buttress walls, spaced on 15-foot centers, which also form the supports for the vertical wood baffle walls. Each agitator or aerator is driven by a 5 h. p. electric motor, through a speed reducing gear with a chain and sprocket drive to the shaft.

Returned activated sludge is applied about 15 feet from the influent end of the tank. The tank volume preceding the application of the sludge is used for pre-aeration, the object of which is to freshen up the sewage by driving off such toxic gases as the sewage may contain, which gases are deleterious to the delicate organisms which constitute the return sludge.

Final Settling Tank

Aerated sewage discharges over a baffled weir into a final settling tank, constructed integral with the aeration tank. Four separate compartments are provided, each 14.5 feet wide and 43.5 feet long, with an average sewage depth of 6.5 feet. Settled sludge is removed by mechanically operated scrapers, driven by a 3 h. p. motor, concentrating the sludge in hoppers located at the influent end of each compartment. These hoppers are provided with perforated water-flushing

pipings to periodically wash down any sludge which may adhere to the sides of the hoppers.

Sludge is removed from each of the hoppers by means of a vertical sludge pipe, extending from the bottom of the hopper to a sludge withdrawal chamber, the bottom of which is 15 inches below the sewage level. An adjustable sludge decanter is provided which slides inside of the sludge riser pipe. This decanter consists of a short length of 8-inch brass pipe having a "V" notch weir cut in the pipe. It slides in a machined flange bolted to the sludge riser pipe and the top is capped for attachment of a threaded stem operated by a floor stand. The decanter can be raised or lowered, depending on the amount of sludge it is required to withdraw. The sludge discharges into a concrete channel extending across the four compartments, from which it is piped to the sludge return compartment.

The effluent from each compartment spills over a rectangular weir into an effluent conduit, from which it is piped to the contact tank.

Activated Sludge Return

Activated sludge from the final settling tank is piped to a sump, from which it is lifted into a distribution tank by means of an air lift. The distribution box consists of a baffled common chamber into which the sludge is discharged, which has a "V" notch weir outlet for each aerating compartment. Each weir spills into a box, from which the sludge is piped to its respective compartment. Adjustable overflow weirs are provided to control the quantity of sludge returned. Excess sludge spills over the overflow weirs and can be discharged either to the sludge digestion tank or to the influent end of the preliminary settling tank. A small amount of air is introduced into the bottom of the distribution tank to keep the sludge in suspension.

Contact Tank and Sterilization

The contact tank consists of a baffled mixing chamber, 12 feet square by 6 feet deep, which receives the sewage from the final settling tank. Chlorine is introduced at the entrance to this chamber and thoroughly mixed with the sewage. A small brick building for



Final settling tank, viewed from effluent end. Taken immediately before the fourth unit was cut into service, using return activated sludge.

housing the chlorinator, scales and chlorine containers is constructed over this chamber.

From this chamber the sewage flows into two compartments, each 12 feet wide by 33 feet long with a sewage depth of 6 feet. Each compartment is provided with round-about baffles spaced on 3-foot centers.

Sludge Digestion Tank

All sludge from the preliminary settling tank and excess activated sludge is disposed of by digestion in practically airtight separate sludge digestion tanks. These tanks are of the so-called high temperature type and are equipped with facilities for the collection and burning of the gas under gas-fired hot-water boilers. Under the present construction, only the heating coils and gas domes were installed, with provisions made for the future installation of the heating plant.

The tank is divided into two separate compartments, each 31 feet wide by 77 feet long, and have a sludge depth of 9 feet, giving a total volume of 43,000 cubic feet. With a present population of 13,000 this is equivalent to 3.3 cubic feet of sludge storage per capita. Horizontal baffles are provided to prevent short-circuiting of the sludge. Digested sludge is removed from the effluent end of each compartment by means of a valved sludge riser pipe and discharged to the sludge drying beds.

To seed and inoculate the raw sludge, the sludge riser pipe is provided with an air lift foot piece to lift digested sludge into a concrete box placed above the tank from which it flows back to the influent end of the tank. Super- or sub-natant liquor is removed by means of a rotary type decanting valve, designed to effect removal from practically any level.

Sludge Drying Beds

The sludge drying beds are divided into eight separate beds, each about 20 feet wide by 63 feet long. A glass covered superstructure is constructed over six of the beds, each cover having a 40 foot span and covering two beds. Sludge is introduced into the beds through an 8-inch cast iron pipe, having a shear gate at each bed. The beds were constructed over an existing contact tank, using the underdrains in place and covering the stone with graded gravel and filter sand. Provision is made to discharge supernatant liquor from the sludge digestion tank onto a part of the bed.

Operating Results

Previous to the construction of the activated sludge treatment plant, the sewage had been treated by settling of the solids in a single-story sedimentation tank, followed by contact beds. However, this plant was overloaded to such an extent that the treatment results were almost negligible. The effluent discharged into a very small pond close by the plant, to which practically no surface water was added except that obtained during rains. This gave rise to a condition which was productive of offensive odors and an aggravated local nuisance, particularly during the warmer season of the year. The growth of algae and higher plant life was intensified by the stagnant condition of the water and by the food for growth provided by the organic matter contained in the sewage effluent.

Since the starting up of the activated sludge plant, this condition has gradually improved. The growth of higher plant life has disappeared and the surface of the water has a slightly green tinge. Oxygen saturation has increased until now it is close to 100 per cent and no odors are apparent. The effluent from the new plant is comparatively clear. The biochemical oxygen demand is reduced from about 200 to less than 20 p.p.m. No trouble has been experienced in the opera-



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tion of the mechanical aerators, which more than meet the results anticipated. Power consumption averages about 10 K. W. per million gallons of sewage.

In starting up the plant, three of the aerating compartments were filled with sewage and allowed to stand full; the sewage meantime flowing through the fourth aerating compartment, with the agitator in operation. In a few days flocculation started in the three compartments. A small volume of sewage was then allowed to enter one of the compartments and such sludge as developed was recirculated in the tank. When the sludge content had been built up to about 15 per cent (one hour settling), the flow was slightly increased and sewage allowed to enter the second compartment. This procedure was followed until the three compartments were fully developed, which required about 10 days. At the end of this time the fourth compartment was cut into service. Precautions were taken to prevent the return of any poor or septic sludge.

The final settling tanks were filled with clean water before they were placed in service and the settling compartment of the fourth aerating unit was thoroughly cleaned out and filled with water before it was cut into service. These precautions, together with periodical flushing of the final settling tank hoppers, were well warranted, as it was possible to secure comparatively good results within about 10 days from starting up. One interesting fact determined was the reduction in biochemical oxygen demand by aeration only, without activated sludge. With a one hour aeration period this was reduced by about 40 per cent.

Starting up the plant and the securing of a good settling flow was comparatively simple as compared to the continuance of good operation. Several times the sludge was practically washed out by excess sewage flows due to storm water. This usually happened during the night when only the night assistant was on duty. Bulking occurred several times and it was necessary to waste practically all of the sludge and start over. Carelessness in operation also caused a certain amount of trouble at first, but this has been eliminated by thorough instruction. However, the plant came back very quickly after these upsets.

Certain preconceived ideas relative to the behavior of activated sludge were practically discarded. At first, intensive efforts were made to secure the golden

brown color, which is supposed to indicate well oxidized sludge. This color was obtained several times, but quickly disappeared. So far, the cause of the disappearance is not known. In general, the color of the sludge is not now used as a criterion but rather the one hour settling test and the appearance of the sludge.

Average operating results for the month of November, 1930, are as follows:—

	Influent	Clarifier Effluent	Final Effluent
Bio-chemical oxygen demand	350	270	25
Suspended solids	340	200	45
Ash content	21	19	12
Turbidity	540	415	120
Relative stability	—	—	7 days
B. Coli	—	—	1
Hydrogen ion concentration	7.08	7.05	7.30
Oxygen saturation (in percent)	—	—	65
Bacterial total count	Nov. 22		5 in 1 c.c.

Sludge from the clarifier and excess activated sludge are discharged to the digestion tank. Sludge was first placed in the tanks in August. When started, the tank was partly seeded with some digested sludge from an old digestion tank.

This together with careful control has caused the digestion to proceed at a fairly rapid rate. Sludge drawn at the end of November, less than four months after starting up, was black, inodorous and dried inside of about three weeks. The sludge showed a pH of 7.0, and liquor drawn off a pH of 6.8.

Remington, Vosbury and Goff, of Camden, New Jersey, were consulting engineers on the project, and the plant was designed under the supervision of the writer.

Machine Finishing of Black-Top Pavement Reduced Labor Costs

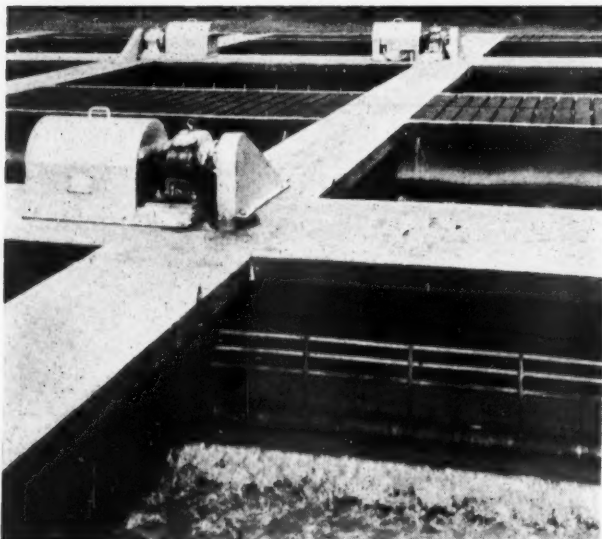
(Continued from page 33)

The finishing equipment used on the above contract was a Type "C" Lakewood finisher, a standard type finisher for concrete pavement which, with a few attachments, may be adapted to the finish of "black-top" pavements. Two 10-ton Buffalo-Springfield rollers were used in rolling both courses.

Work was performed under jurisdiction of Howard E. Smith, district engineer. Inspection visits to the job were made by district engineer Smith and assistant district engineer Larsen. William Garbino was project engineer; Roy Hutchinson, chief inspector, was in direct charge of the contract. Ralph Smith acted as superintendent in charge of the work for the contractors. District engineer Charles R. Waters, of the Buffalo District, also made an inspection trip over the work to view the machine finishing operation. General satisfaction was expressed by engineers as to the contractor's method of finishing the pavement and as to the quality of surface ultimately obtained.

The contract amounted to \$575,688, and involved, in addition to the paving, approximately 125,000 cubic yards of unclassified excavation.

Although machine finish for asphaltic pavement work is not indicated in the New York State specifications for the present year, engineers of the Rochester district anticipate requesting special permission for use of same on future work of this character. Various other states have been employing this method



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for some time past. California, New Mexico, Texas, Oklahoma, Mississippi, Georgia, North Carolina, South Carolina, Florida, and Michigan have utilized finishing machines on so-called "black-top" roads in their systems. Some states, notably California and South Carolina, require this method of finishing in their specifications. Practically all of California's asphalt work on state road jobs are, however, of the hot mix type. Machine finish has not yet been undertaken by New York State on hot mix jobs.

This article is reprinted by the courtesy of "The Low Bidder," official publication of the New York State Chapter, Associated General Contractors of America, Inc., F. B. Dyer, publication manager.

An Australian Engineer's Impressions of American Highways

(Continued from page 31)

Bitumen costs \$36 per 2,000 lb. ton, F. O. W., and cement \$4.40 per 375 lb. barrel at the factory; so roadbuilding is a very expensive proposition. Fortunately, we have no frosts, so penetration macadam is the principal type of construction; but, as in many other countries, the low type of improved roadway is our salvation. However, we can boast a 60-mile-per-hour highway 900 miles long, bordered all the way with evergreen trees and traversing rich wheat country, rolling sheep downs and the green dairy and fruitgrowing districts adjacent to the big cities. Certainly nature has been kind to Australia with unsurpassed scenery.

I believe the American highways could be improved by eliminating bizarre signs proclaiming hot-dog emporiums or candy kiosks. These signs mar the natural beauty. The owners should not be allowed to proclaim their wares in so hideous a fashion. The Ontario Highway Department has shown great wisdom in not allowing any signs to be erected within sight of the highway on the river side of the route from Montreal to Toronto. Some states are well advanced in the question of supplying the aesthetic as well as the utilitarian needs of the automobile owners. Every year more of the maintenance allocation is devoted to tree planting and obtaining parcels of land suitable for picnic spots. This is indeed money well spent. Let the motto be: "Less Signs, More Trees."

While attending the Annual Convention and Road Show of the American Road Builders' Association I was much impressed by the immense number of road builders gathered to study new methods and machines. This great meeting is symbolic of the great strides the United States has made in road building.

Low-Cost Residence Streets

(Continued from page 28)

not found it necessary to add the gravel as was done in Elizabeth City, but have used the local top soil at a lower cost. In Elizabeth City, however, the most economical aggregates were the imported gravel and limestone, since no acceptable top soil was available locally.

The Elizabeth City work was done under the direction of Miles W. Ferebee, city manager, who says, in a letter dated December 5th, 1930: "The plan described in this article gave the city of Elizabeth City some excellent streets which are still in splendid condition."

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RECENT LEGAL DECISIONS

By John Simpson

HIGHWAYS

Silent Policeman Sufficiently Conspicuous Not a Defect

The West Virginia Supreme Court of Appeals *Riley v. City of Roncverte*, 151 S. E. 174, takes judicial notice of the common use of "silent policemen" at street intersections in cities, towns and villages, and that they serve a useful purpose in directing traffic and promoting a proper observance of the law of the road. It holds that the presence of a sufficiently conspicuous "silent policeman," although not painted or equipped with a warning light, is not a "defect" in the highway within the meaning of the statute (Code c. 43, § 167) giving a right of action for defects caused by lack of repair, if the city maintains, with reasonable diligence, lights in the vicinity thereof sufficient to inform travelers exercising ordinary care in the use of the way by night of its presence.

Mandamus Not Allowed to Pay for Extra Excavation

Contractors who graded a section of state road under contract with the state road commission were held not entitled to mandamus to compel the division engineer to make a final estimate showing, and the commission to pay for, excavation in rock cuts below the grade of the crown of the road, where the contract was made in conformity with a plan of such construction work which did not show a horizontal line below the radius of the crown of the road indicative of the maximum pay line in rock cuts, and where it did not appear that the said excavation beneath the crown of the road was outside of the contract and was ordered as "extra" by an authorized representative of the state road commission. *Black v. Fortney*, West Virginia Court of Appeals, 151 S. E. 319. The court said: "Where there is not a plain legal duty to be performed [by public officials], mandamus will not lie. There is no duty, statutory or otherwise, devolving upon the commission to pay for work for which it did not contract to pay, or which, not being under the terms of the contract, was not performed under direction or order of an authorized representative of the commission as extra work. The situation is in no wise controlled by a recommendation of one of the commission's engineers that the work should be paid for. Such recommendation does not affect the contract."

Contractor's Right to Have Rock Condemned for Road Work

The West Virginia Supreme Court of Appeals holds, *State Road Commission v. Miller*, 151 S. E. 436, that where the state road commission has received and accepted a bid for the construction of a section of a state highway, and the bidder refuses to enter into the contract and give bond to perform the same unless the commission, as part of the contract, will condemn rock adjacent to and necessary for the construction of the road, which the bidder cannot otherwise obtain at a reasonable price, and the commission, in order to have the road constructed expeditiously and economically and conserve an urgent public need, does so agree and files its petition under the state statute giving the commission power to condemn materials to be used in the construction and maintenance of state roads, the condemnation will not be considered as

taking private property for private use although the contractor might incidentally receive some benefit therefrom under his contract.

Accounting Between Road Construction Contractors

Where two companies engaged in road construction work agree that a proposal to do certain work shall be made by one of them to the state road commission for the benefit of both, and such proposal is accepted by the commission and a contract is entered into between the commission and the company making the proposal and in pursuance thereof, the West Virginia Supreme Court of Appeals holds, *Ohio Valley Builders' Supply Co. v. Wetzel Const. Co.*, 151 S. E. 1, that the two companies must be considered as joint adventurers in the project. Where the company not making the proposal undertook to do the work, but proceeded in such an unsatisfactory manner that the other company properly took over the defaulting company's portion of the job and completed it for its benefit, using the defaulting company's equipment and material on the ground, the active company accounting to the defaulting company for the work done by the latter, the defaulting company was not entitled to recover from the active company rent for the use of its equipment after the default.

Unauthorized Contract to Use Road Under Construction

A contractor constructing a state highway for the commonwealth of Massachusetts about 4½ miles long near the Vermont state line contracted with a contractor constructing a highway in Vermont to allow the latter to haul 25 tons of stone a day over the road under construction for \$.15 per ton and payment of any damage to the highway, and 4,231 tons were so conveyed. In an action for payment therefor, the Massachusetts Supreme Court held, *New Haven Road Const. Co. v. Long*, 168 N. E. 161, that the plaintiff in making this agreement violated the express terms of its contract with the state requiring that the road be closed to through traffic, and exceeded its authority. It would be against public policy to permit the plaintiff to collect money from defendants for the use of the road as travelers. And plaintiff could not recover damages caused by a use which it was not authorized to grant.

WORKMEN'S COMPENSATION

Workmen's Compensation Act—Transportation of Steam Shovel

Where a paving company hired a steam shovel and its operator from the operator's employer, and directed him to get the shovel ready to be transported and to leave with it the next day, the Pennsylvania Supreme Court holds, *Lobos v. Union Paving Co.*, 298 Pa. 381, 148 Atl. 500, that the operator's death by falling off the trailer on which the shovel was being transported from one town to another was in the course of his employment within the Workmen's Compensation Act.

Agreements Between Contractor and Subcontractor as to Insurance

Where a subcontractor agrees with the general contractor, who accepts the provisions of the Pennsylvania

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Workmen's Compensation Act, to carry compensation insurance under the act, the general contractor is relieved of liability to a subcontractor's employee paid from such insurance. The agreement does not take the general contractor out of the act, so as to make him liable in a common-law action; he would be liable under the act if for any reason the subcontractor or his insurer was irresponsible.—*Swartz v. Couradis*, 298 Pa. 348.

Driller of Holes in Quarry Held Employee of Paving Company

In an action to review an award for compensation for injuries sustained by the claimant while drilling holes in rock at a rock quarry for a paving company, it was claimed that the company was not liable because claimant was not its employee, but an independent contractor. The claimant used a machine owned and maintained by the company. Payment was to be of a certain sum per foot drilled. A helper was necessary and the employer reserved the right to, and did, employ the helper and paid him by check, the amount thereof being deducted from the price of the drilling. The employer reserved the right to determine the location and depth of each hole, and directed where the machinery was to be moved from one location to another. The claimant was required to give his personal attention to the work and was not free to employ some other person to operate the machine. The Oklahoma Supreme Court held, *Western Paving Co. v. Commission*, 284 Pac. 304, that the claimant was an employee within the meaning of the Workmen's Compensation Act, and not an independent contractor, although he himself had control of the hours of work and was required to furnish the gasoline and oil for the operation of the machine.

"Premises" of a Highway Construction Contractor

The employee of a construction company, whose duty it was to unload cement from a railroad freight car for the paving of a highway two miles away, had completed his work and started home, he was injured when he stopped at the scene of the paving operations to wait for an employee working there. The Wisconsin Supreme Court held, *E. W. Hallett Const. Co. v. Industrial Commission*, 229 N. W. 547, that the injuries did not occur on the employer's "premises" while the employee was going from his employment in the ordinary or usual way, within the Workmen's Compensation Act. He was injured on the employer's premises, but not on the premises where he worked. Although the employer was under contract to pave the highway, that did not make its entire length the premises of the employer.

CONTRACTS

Construction of Grading Contract

A grading contract between a road contractor and a grading contractor read as follows: "I hereby agree to do all grading necessary on Road No. 12B for 30 cents per cu. yd., 32½ cents where any shooting is required in ditches." This was signed by both parties. Both knew of the county engineer's preliminary estimate of the yardage to be moved. Monthly payments were made for the grading according to the engineer's monthly estimates. When the work was done the grading contractor claimed payment for the yardage actually moved; the road contractor contended he was bound by the engineer's preliminary estimate. The yardage was not measured by the engineer after

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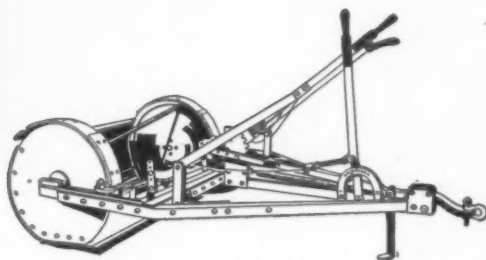


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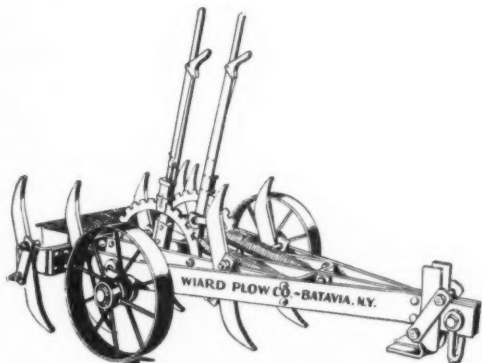
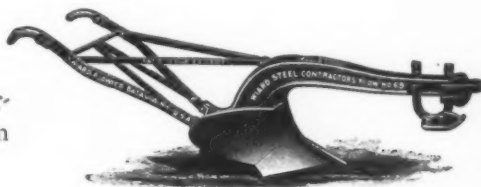


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the work was done. He claimed there was no change of grade and no subsequent measurement was necessary. In an action by the grading contractor against the road contractor, *Holm v. Mallott*, Washington Supreme Court, 287 Pac. 11, evidence for the grading contractor that the grade was changed and the engineer's estimate was exceeded was held admissible. The grading contractor was not estopped from claiming payment for yardage actually moved by accepting monthly payments. The yardage removed was for the jury. The question was whether the original estimates were exceeded irrespective of whether the grade was changed or not. The grading contractor's claim being for yardage actually removed, a requested instruction that he could not recover for excess yardage removed unless the road grade had been changed was held properly refused. Judgment for plaintiff was affirmed.

Employment Contract to Build Bridge

The Wyoming Supreme Court holds, *Farmers State Bank v. Riverton Const. Co.*, 275 Pac. 128, that a contract of a construction company which had contracted to build a bridge for the United States, procuring another to build the bridge and furnish the materials for the work was merely an employment contract and not invalid as an "assignment of claim" against the government under Rev. St. U. S. §3477 (31 U. S. C. A. §203).

Grading Contract Ambiguous As to Cost of Subgrading

A contract for grading at 30 cents per cubic yard, "including subgrading and finishing the shoulders," was held ambiguous by the Alabama Supreme Court, *Lassiter & Co. v. Nixon*, 119 So. 17, because it was impossible to determine whether the work of subgrading and finishing the shoulders was included as part of the grading, or whether payment for such subgrading was to be made in addition to the other grading. Since, however, the grading contractor knew that the paving contractor had a contract with the state for grading at 30 cents per yard, and that it was the interpretation of the State Commission that this contract included as an incident thereto the subgrading, for which no pay was provided, the court resolved the ambiguity against the grading contractor, although the contract was drafted by the paving contractor.

Compensation Claim by Road Contractor's Employee

An independent contractor employed to haul concrete for a road contractor at a specific price per batch was told one morning that the regular work could not be done because it was raining, and that the road contractor wanted some special gravel hauled for a bridge, for which the road contractor would pay him \$2.50 an hour. He agreed to do the work and, on returning from the place designated, he found a concrete mixer so located that it had to be moved to place the gravel where he had been instructed to place it. He was injured while cranking the engine of the mixer for the purpose of moving it, and claimed under the New York Workmen's Compensation Act as an employee of the road contractor. The Appellate Divisions holds, *Friona v. Wendling*, 243 N. Y. S. 571, that the claimant assumed a new relation on the day of the accident and became, for the time being the employee of the road contractor and was entitled to an award under the act.

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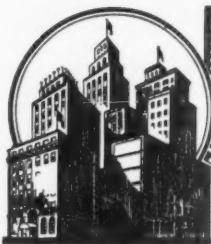
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Reports on Highway Matters by the A. R. B. A.

(Continued from page 40)

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3. Drainage, including storm and sanitary sewer and drain tile.
4. Surfacing of runways.
5. Surfacing of landing areas.
6. Surfacing of hangar aprons and automobile highways.
7. Miscellaneous structures, such as pedestrian subways, guide rails and fences.
8. Topsoil for field to be turfed.
9. Automobile parking areas.
10. Shoulders.

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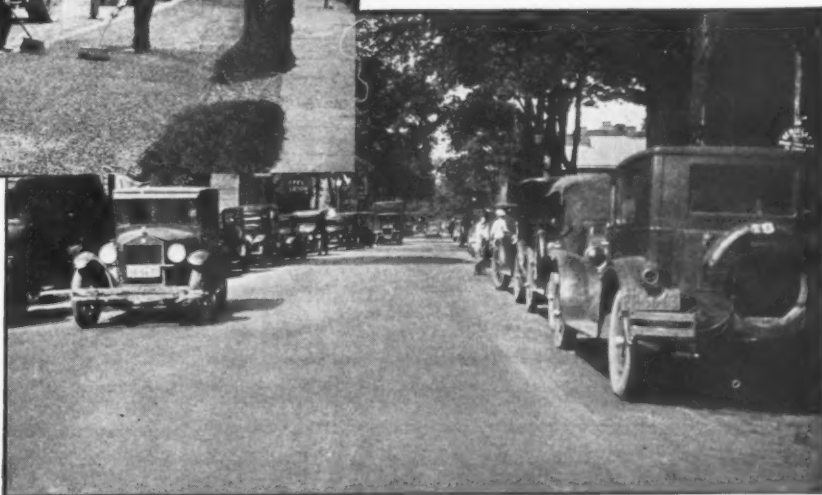
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Few general contractors are qualified to handle all of these various kinds of work, and it may be best to let the work in two or more contracts.

Traffic Requirements for Traffic-Actuated Signals

A traffic-actuated signal is a stop-and-go light at a highway intersection which is operated by a vehicle on approaching the light. If a continuous string of vehicles is travelling on each street, the signal automatically operates on a time period like an ordinary stop-and-go light; if there is only one vehicle or is a break in the traffic on the cross street, the signal turns back to clear on the main thoroughfare as soon as the last vehicle on the cross street has passed.

Traffic-actuated signals may be used to advantage at the following locations:

(1) At isolated intersections where the flow at maximum hours warrants signal control, but for the remainder of the day, falls below standard requirements.

(2) Where the flow on the lighter traveled street does not equal 25% of the total, but pedestrian movement is heavy.

(3) Where physical conditions render the intersection unsafe for vehicles approaching from the lighter traveled street.

(4) Where the traffic on the lighter traveled street could not safely negotiate the crossing because of uninterrupted flow of traffic on the heavier traveled street, the minimum flow on the heavier traveled street being approximately 600 vehicles per hour in two lanes, flowing in opposite lanes.

Although traffic-actuated signals have been in use for some little time, they still may be classified as being in an experimental stage. Their use is restricted to outlying districts where one of the streets is of materially greater importance than the other.

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(Continued on page 91)

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Monthly Digest of Water Works Literature

(Continued from page 30)

darco, and the 5 p. p. m. of color were eliminated. The rate in terms of a 24 inch carbon bed was 125 m. g. d. with upward flow. From April 1 on, with rates of 100 m. g. d. and with odors increasing with the increase in temperature of the water, noticeable odors prevailed in the carbon filter effluent after 4 weeks.

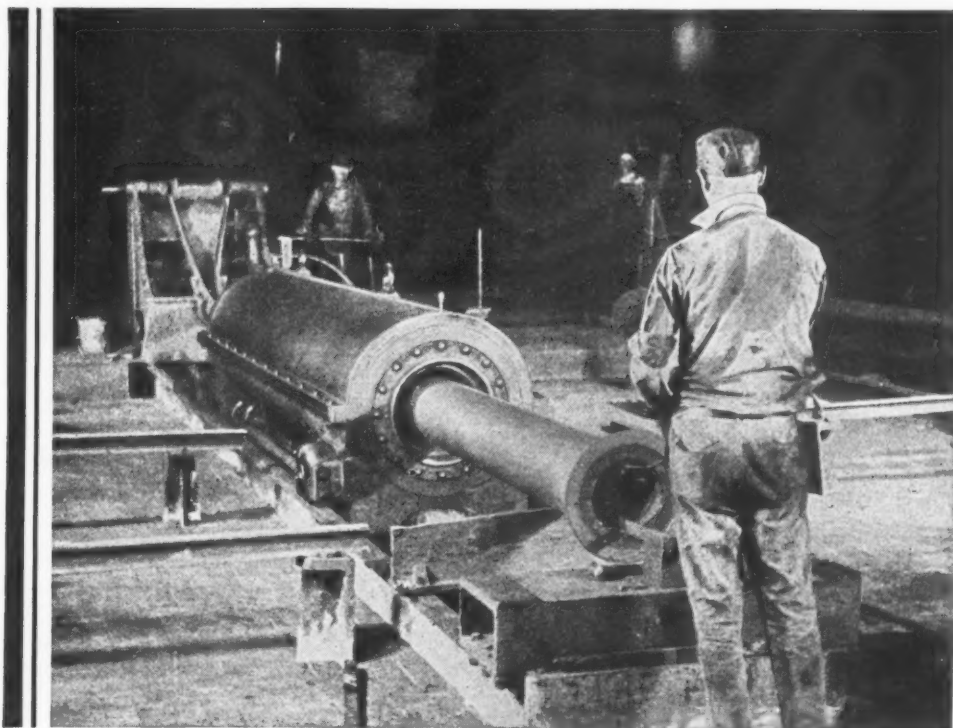
At the Dupont Company plant¹⁵ 1 mile north of Buffalo, where the Niagara river water is coagulated with alum and filtered through rapid sand filters, a small part of this effluent is passed through a carbon filter for drinking water use. The raw unfiltered river water is highly contaminated with Buffalo sewage, and prechlorination is practiced to prevent septic action in the coagulation basins and to keep the bacterial content at a minimum. The initial chlorine dosage is from 6.2 p. p. m. to 0.4 (average 0.81 p. p. m.), and the residual chlorine is 0.25 p. p. m. There is a chlorine taste in the drinking water. For 6 years the activated carbon removed the chlorine taste, but not the chlorophenol taste. The carbon used was boneblack containing 9-10 per cent carbon, being supported between 2 discs of fine silver-coated copper wire cloth. The upward flow rate averaged 3.2 g. p. sq. ft. p. min. The filters were backwashed daily by reverse flow. The carbon was revived by steam applied from the top for 45 min. The activated carbon has been replaced 90 per cent since the installation of the plant 6 years ago.

As Hansen¹⁵ points out, various problems require solution before activated carbon can be accepted as a satisfactory municipal water supply treatment process. These problems concern: (1) The disintegration of the carbon; (2) the life of the carbon with waters of various turbidities; (3) the cost of the carbon; (4) method of revivification; (5) economical plant design; and (6) application to various water supply impurities.

Various measures for increasing the efficiency of water purification processes³⁵ are: (1) Increased coagulant dosage; (2) prolongation of the sedimentation period; (3) the use of lower filtration rates and finer sand in filters; (4) superchlorination of filter effluents; (5) double-stage coagulation, sedimentation, filtration, or chlorination, either singly or in combination; (6) excess-lime treatment; (7) pH control of the coagulation reaction; (8) use of floc detectors and more highly refined turbidimeters; (9) amplification of routine tests for residual chlorine and chlorine demand; and (10) use of jar tests for gauging the amounts of coagulant required.

Experimental observations by the U. S. Public Health Service and surveys of municipal filtration plants treating Ohio river water show that greater sedimentation capacities and more coagulant than ordinarily practiced produce material increases in the bacterial efficiency of many rapid sand filtration plants. Further observations show that Ohio river plants equipped with double-stage coagulation-sedimentation can produce effluents meeting the Treasury Department B. coli standard from raw water having a B. coli index exceeding about 50,000 per 100 c. c., whereas the Ohio river plants with single-stage treatment of this kind do not appear able to produce an effluent of the same standard quality from raw water having a B. coli index exceeding about 5,000 per 100 c. c.

Studies on raw-water prechlorination, followed by the usual post-filter chlorination, gave the following



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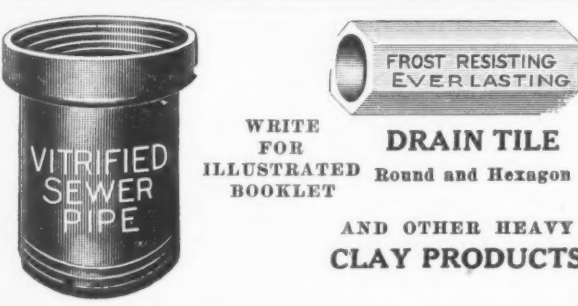
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limiting densities of raw water B. coli consistent with the production of an effluent meeting the Treasury Department B. coli standard:

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With post-filter chlorination	22,000	10,000
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Double filtration is not as popular in the U. S. as in England, because of the extra pumping head required where the purified water supplies are pumped, and because the high turbidity of our waters necessitates thorough preliminary treatment.

Experiments with the excess lime treatment show the following disadvantages in comparison with prechlorination: (1) Its more erratic performance; (2) the longer period of time required to complete its action; and (3) the considerable difficulty experienced in maintaining a high degree of constancy in the residual pH or causticity.

In rapid sand filtration plants treating water of fairly high alkalinity, it may be possible to increase the bacterial efficiency by artificial reduction of the pH to the range 5.5-6.8.

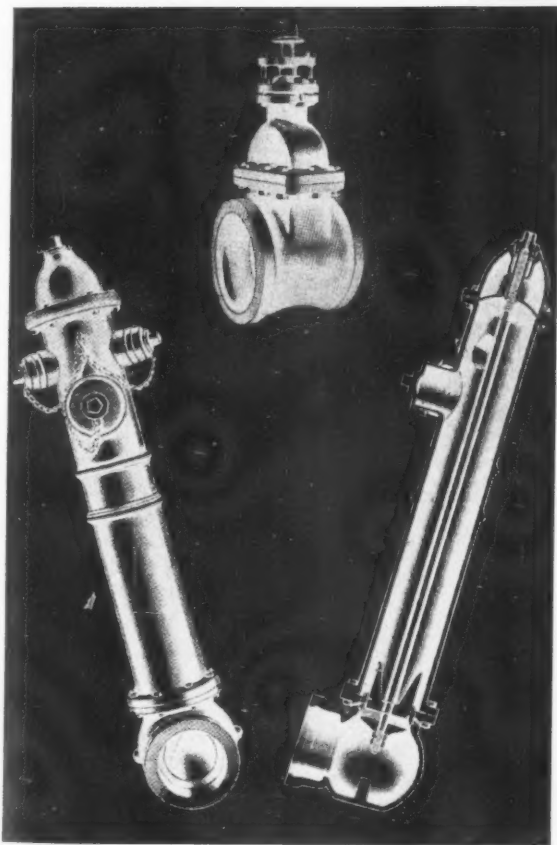
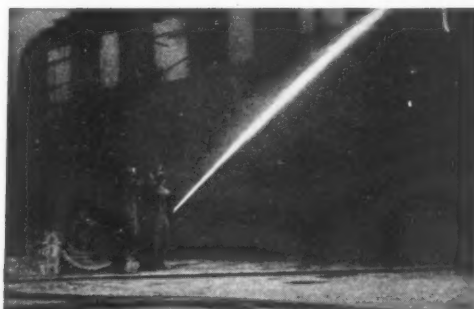
Hard-water³⁷ states are Ohio, Indiana, Illinois, Iowa, South Dakota, Nebraska, Kansas, Arizona, Florida, and part of Pa. An investigation at Columbus, Ohio, in a home of 3 adults and 2 children as to the relative merits of hard and soft water use showed: (1) This family could afford to pay 5 or 6 times as much for softened water as for unsoftened water; (2) one-half again as much time was needed to launder clothes in the unsoftened water as with the softened; (3) the clothes washed in the unsoftened water were not entirely satisfactory; and (4) the general appearance of the clothes washed in unsoftened water was poor. Hard water has a bad effect upon plumbing. Hard water can generally be softened by plants costing \$35,000-\$75,000 p. m. g. capacity. The cost of chemicals used in softening the water at Columbus, Ohio, was approximately 11 cents per 1 p. p. m. of hardness removed from 1 m. g. of water.

Two zeolite water-softening units¹⁰ of 610,000 g. p. d. capacity installed in the municipal well water system of Springdale, Pa., in 1929 reduced the hardness from 20 to 4 gr. p. g. Part of the supply is treated to zero hardness and then mixed with the remainder. The final water is chlorinated.

For the best methods of reducing air-binding in existing filtration plants,²³ Baylis recommends: (1) Washing the filters at a lower loss of head; (2) preventing the air from entering the water, if the trouble is due to air leaks in the suctions of pumps; and (3) lessening the algae growths in reservoirs. For new plants, he recommends designs involving: (1) Little if any tendency for the temperature of the water to increase before it passes the filters; (2) placing the location of sand beds below the water level sufficiently to prevent any negative head in the sand beds at the maximum loss of head; and (3) spraying the water into the air before entering the plant.

Ammonia and chlorine treatment²⁴ in the two Cleveland filtration plants since Jan., 1930, has shown residual chlorine in the water at the extreme ends of the distribution system (about 5 days after leaving the plants), no B. coli, and extremely low bacterial counts, some of the water passing through two open reser-

For years he bought hydrants and valves ... *then he built them*



MR. H. M. LOFTON, the founder of this business, has been on both sides of the desk. For years as Superintendent of Water Works in a large Southern city he was responsible for the purchase, operation and maintenance of fire hydrants and valves.

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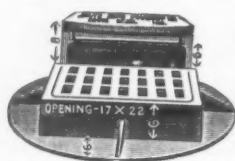


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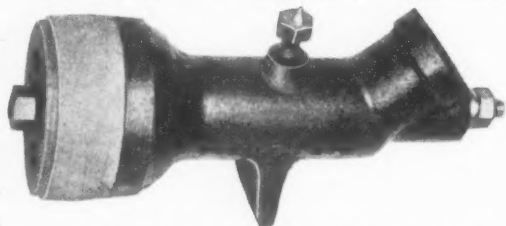
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voirs. Accordingly, Lawrence recommends chloramination to keep down aftergrowths in filtered water in distribution systems.

The improvements to the Bloomington, Ill., public water supply,⁴ which were completed in April, 1930, include an impounding reservoir, a 5 m. g. d. lime and alum water softening and rapid sand filtration plant, pumps, and discharge line. The impounded lake is used for water sports. The water is aerated, softened, recarbonated, and filtered, the 200-240 p. p. m. hardness of the raw water being reduced to 85 p. p. m.

Cooperative daily bacteriological analysis¹⁹ of the Baltimore city water by the Water and Health Departments since Sept., 1926, produced comparable results; showed the possibility of contaminating water samples with melted ice water from ice used in water sample cases; and made it advisable to establish a definite system of daily chlorination of the water in the open reservoir of the distribution system to destroy the B. coli which occurred in the house tap samples. This chlorination is in addition to the chlorination of the filtered water at the purification works.

At Rochester, N. Y.,¹⁸ tests on 300 water samples from 91 different sources showed the new methylene blue bromocresol purple medium of Dominick & Lauter far superior to standard lactose broth for the detection of B. coli in water.

The recommended form²⁸ for monthly reports by filter plant operators is a single sheet folded in a size convenient for filing, and will readily permit of detailed comparisons of filter plants.

The Manila water supply¹¹ is obtained from impounding reservoirs and is treated with a small amount of chlorine. Due to the high typhoid rate and occasional high bacteria counts in the public water, a rapid sand filtration plant is now being completed. This water supply is supplemented by public and private wells, mostly artesian, of about the same sanitary quality as the public supply. In small areas, the water is distributed in carts with operators licensed by the Division of Sanitary Engineering of the Philippine Health Service. Licenses are issued depending upon the cleanliness of the carts and physical condition of the individuals handling the water. The city water is provided by the Metropolitan Water District.

A diary²⁵ for water and sewage plant accomplishments is invaluable.

Apparently, regarding the teeth of persons,²¹ any enamel in the process of formation during residence in an endemic district will become definitely mottled and defective, due probably to some factor of the water supply in such a district. Endemic districts are located in Italy, certain of the Bahama Islands, Barbados, Holland, Cape Verde Islands, China, Mexico, Spain, Argentina, other South American countries, South Africa, parts of Colorado, Texas, Virginia, Arizona, South Dakota, Idaho, California, Illinois, North Dakota, Minnesota, and Arkansas. In Bauxite, Ark., having a deep well water, 202 out of 458 children from 5 to 18 years of age examined had mottled enamel of the teeth. The findings resulted in the abandonment of the well water supply and the installation of a water supply from Benton, 4 miles away, where this condition does not exist. Oakley, Idaho, changed its water supply for similar reasons. Pozzuoli, Italy, changed its water supply and was no longer afflicted in this way.

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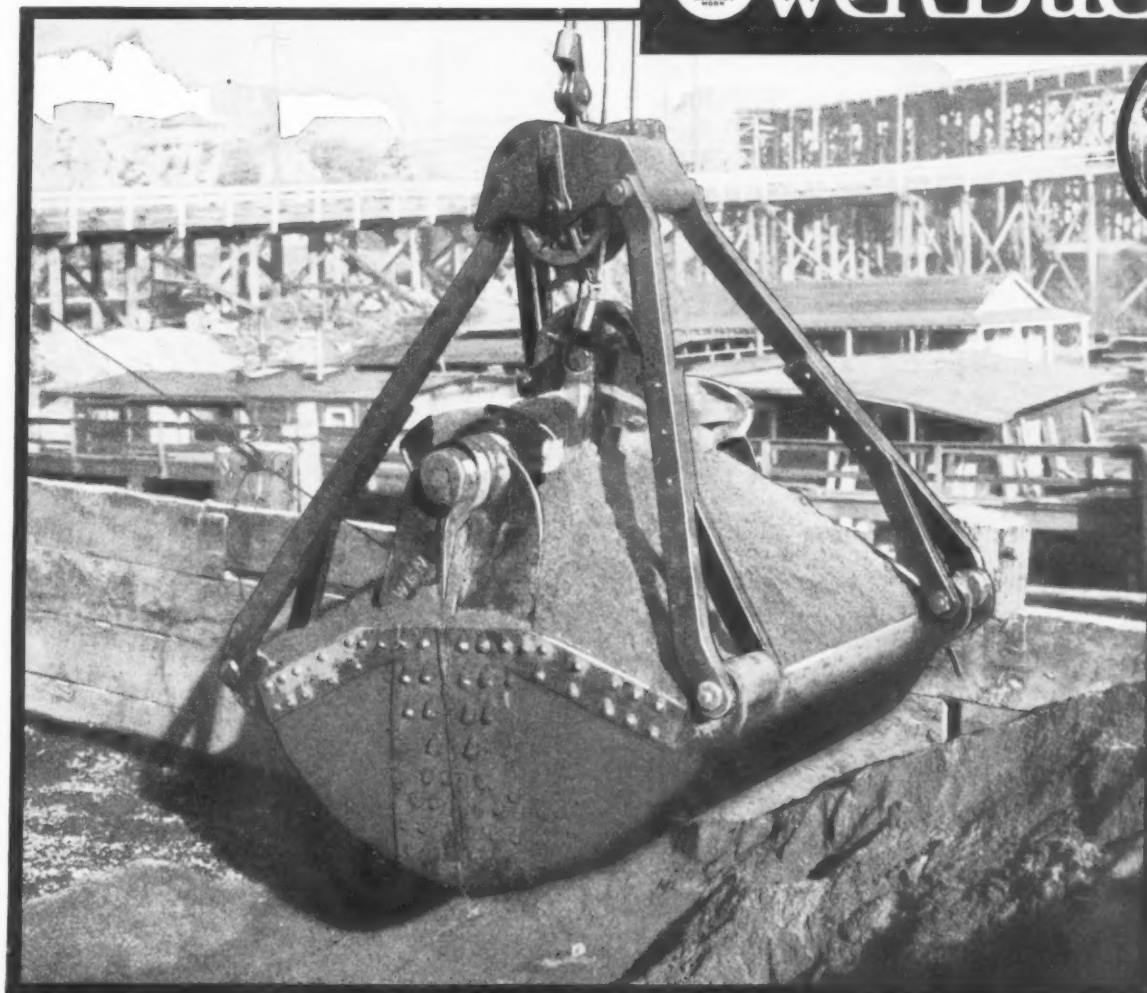
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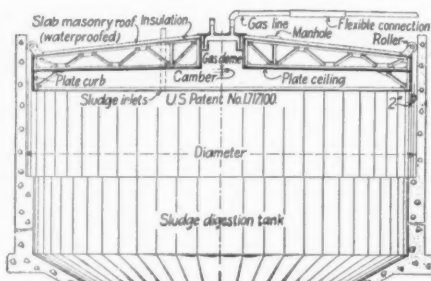


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the hard well water retarded Bloomington's growth, 25 leading citizens organized a local company in 1928, each taking one share of \$100 stock. The construction cost of the new water works of \$1,200,000 was financed through the sale of \$900,000 bonds and \$300,000 cumulative six per cent preferred stock sold locally. The company is a non-profit organization and wholesales water to the city at 13 cents per 1000 g. for the first 3,000,000 g. p. d., 11 cents per 1000 g. for the next 3 m. g. p. d., and 9 cents per 1000 g. for all thereafter. About 2 cents of this charge is for the sinking fund. These rates were established to pay operating expenses, fixed charges, and provide a sinking fund to retire the investment in 15-20 years. At that time, after retiring all outstanding bonds and preferred stock, the 25 stockholders will each receive \$100, the corporation will be dissolved, and the property transferred to the city without cost.

The cost of the water softening plant at Springdale, Pa., was defrayed by bonds issued directly against the municipally owned waterworks, as though it were privately owned. The plant earnings were pledged for the payment of interest and sinking-fund charges of the bonds. This would not increase the bonded indebtedness of the town. A study of the legal digests showed the question of legality of this method of financing was never presented to the state supreme court. The personal opinion of several municipal bonding attorneys was that the enabling act was constitutional, and the bonds could be safely issued and sold, but they hesitated to certify to the legality of the bond issue because the act had never been tested in court. The state department of internal affairs approved the bond issue, and the municipal authorities sold the bonds in 1929, although in 1921 the voters had disapproved the issue.

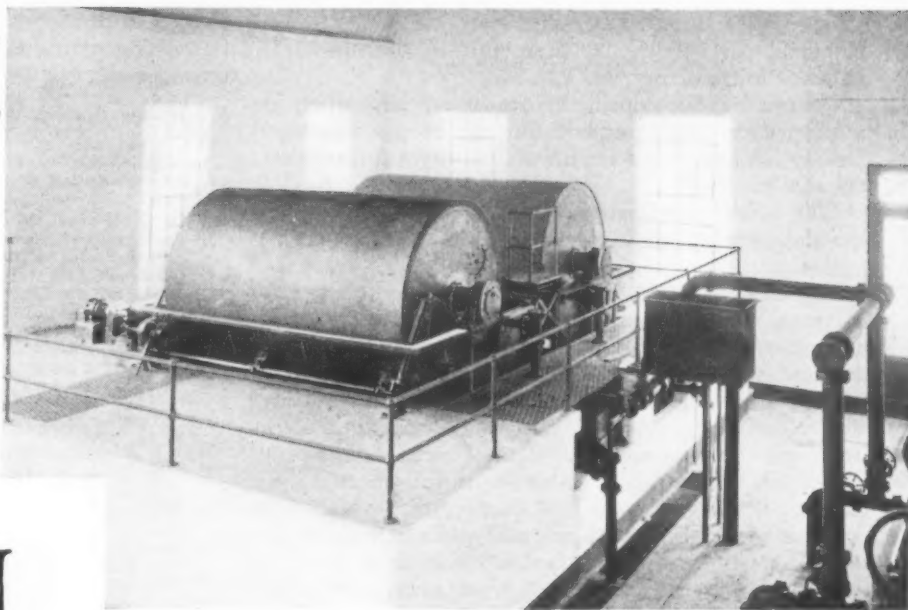
A feature of the new 4 m. g. d. rapid sand filtration plant at Griffin, Ga.,² for purifying river water, is the fact that, of the total cost of \$425,000, only \$184,000 was obtained from bonds, the remainder being from the profits of the public Water & Light Department during the past few years.

Methods for improving the efficiency of the Springfield, Mo.,²⁷ public water distribution system include:

(1) Yearly efficiency tests on pumps at the pumping station, and necessary overhauling of bearings and liners, and removal of any corrosion; (2) supplying the station with water for cooling the pump bearings, laboratory work, and other purposes from the first stage of two-stage pumps, resulting in an appreciable saving in power loss; (3) testing and overhauling filters in the early spring; (4) testing the valves on the various lines around the station; (5) always having on hand a supply of the various fittings and pipe to repair breaks in the distribution system; (6) having maps and records giving complete details of the distribution system; (7) systematically flushing dead ends and low points in circulating mains during the year; (8) laying water mains with special attention to adequate support; (9) installing service connections on the side of the main 90° from the top joint, with goose necks having slight bends in a horizontal plane; and (10) careful testing of all outgoing and incoming meters. The meters are set at the curb in safe meter boxes opening quickly.

Direct fire flow tests²⁸ using existing fire hydrants are made to determine any obstructions to water flow in the distribution system.

Interesting data on the regulation of plumbing for water services outside the corporation limits⁵ of va-



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rious cities and villages of the state are presented in Report No. 1147, N. Y. State Bureau of Municipal Information, Albany, N. Y.

Waukesha, Wisconsin, ³hydrants are kept open in winter, with careful supervision and proper drainage. Frozen house services are thawed out by a special electrical outfit.

The public water supply of Lynchburg, Va.,¹ was developed from wells and springs in 1823 to the present system with rapid sand filtration and 40,500 consumers.

The American Water Works Association objects to any sanction of **bare neutral wiring**¹⁶ by the Electrical Committee of the National Fire Protection Association, because this action would place electric power and light systems in the same class with electric railway systems as sources of stray current on water main systems; and because such a method of electrical distribution inherently tends to disseminate stray electric current to house piping and all other metallic structure systems in buildings with fire and other hazards to life and property.

Concerning the **liability of water works for damages from shutting off supply**,³⁵ various courts have held that: (1) Where the water system is conducted by the municipality in part for profit, even if principally for public purposes, the municipality is liable for damages caused by its negligent management, because such duties are purely ministerial; (2) a citizen who is entitled to be furnished with water is under a correlative duty to pay the company therefor according to its rates, and in the manner prescribed by its rules, and that failure to do so gives the company the right to discontinue the use of the water to the delinquent, and when it exercises this right in a proper and reasonable manner it is not liable in damages; (3) a city is liable for its negligence in shutting off water supply, although by contract the consumers relieve it from liability if the water is shut off to make repairs; (4) a water company is liable in damages to a private individual for cutting off water supply where it is shown that discontinuing the supply was not justified.

Blacksville, W. Va.,³⁰ with a population of 358, passed a bond issue of \$11,000, and built a well water system in 1928. Extensions of **water mains** have been **paid for by citizens** desiring the service, the council permitting them to finance the improvement and giving them free water until they are reimbursed. The rates are \$1.00 for the first 1000 g., 75 cents for the next 1000 g., 50 cents per 1000 g. for the next 3000 g., and 40 cents per 1000 g. for all over this.

In **prospecting for ground water supplies**,³² the procedure involves: (1) A preliminary survey of the topography, geology, and ground water resources of the region; (2) a more detailed survey of all apparently important localities; (3) chemical and bacteriological analyses of the waters of neighborhood wells; and (4) preparation of a complete report with recommendations.

Municipal water and fire departments²⁶ may cooperate in: (1) The planning and laying of water main extensions; (2) the selection and location of hydrants and valves; (3) the proper maintenance of fire hydrants; (4) the immediate notification of the pumping station in case of fire; and (5) permitting the use of old fire hose for reservoir washing.

It was not until 1776 that N. Y. City³⁴ had a **public water supply system**, water being provided prior to that year from wells and streams.

Since 1900 when there were 67 public pools in the U. S., there has been a great increase in **swimming**

pools,³¹ both indoor and outdoor; also in state regulation of swimming pools, and in the practice of refiltration of water for use in them.

Bibliography of Monthly Water Works Literature

*The three outstanding articles.

American City, Vol. 43, No. 5, Nov., 1930.

1. The Evolution of a Southern Water-Supply. p. 107-8.
2. The New Water-Supply Development at Griffin, Ga. R. G. Hicklin, p. 113-6.
3. Keeping the Services and Hydrants Open in Winter. James F. Hamilton. p. 129-30.
4. Citizens Privately Finance New Water Works for Bloomington, Ill. L. R. Howson. p. 131-4.
5. N. Y. State Plumbing Regulations for Property Served with Water Outside Municipal Limits. p. 161.
6. Sanitary Features of Irrigation. Jane H. Rider. p. 1187-91.
7. *Blasting a Precast Dam into Place. C. P. Dunn. p. 159-64.
8. Supplying Water to a Large Memorial Fountain. Charles B. Burdick. No. 19, Nov. 6, p. 724-6.
9. Municipal Water Use in Arid and Semi-Arid Regions. N. T. Veatch, Jr. No. 20, Nov. 13, p. 761-3.
10. Zeolite Water Softening Plant Installed at Springdale, Pa. J. F. Pierce. No. 21, Nov. 20, p. 800-2.
11. Sanitary Engineering and Public Health in Manila. Harold E. Babbitt. No. 21, Nov. 20, p. 808-10.
12. *The Chemical and Mechanical Utilization of Activated Carbon in Water Purification. A. S. Behrman & H. B. Crane. p. 1399-1413.
13. Activated Carbon for the Removal of Taste and Odor. George D. Norcom & R. I. Dodd. p. 1414-7.
14. Further Observations on the Use of Activated Carbon in Removing Objectionable Taste and Odors From Water. John R. Baylis. p. 1438-61.
15. Activated Carbon in Water Treatment Discussion. p. 1462-75.
16. The Water Works Operator's Objections to Bare Neutral Wiring. Charles F. Meyerherm. p. 1476-9.
17. Shallow Sedimentation Basins. Wilfred F. Langelier. p. 1484-9.
18. Comparison of the Dominick-Lauter Presumptive Test With "Standard Methods" Test for Bact. Coli in Water. Harold W. Leahy. p. 1490-4.
19. Open Reservoirs and the Sanitary Control of Tap Samples. C. Leroy Ewing & Edward S. Hopkins. p. 1495-1505.
20. The Buttressed Dam of Uniform Strength. Herman Shorer. p. 1947-69.
21. Mottled Enamel in a Segregated Population. Grover A. Kempf & Frederick S. McKay.
22. *Water Works and Sewerage*, Vol. 77, No. 11, Nov., 1930.
23. Air-Binding of Filter Beds. John R. Baylis. p. 379-84.
24. Experiences at Cleveland with Bacterial Aftergrowths in Distribution Systems. W. C. Lawrence. p. 384.
25. The Works Operators' Confidant. Morris M. Cohn. p. 385-6.
26. Why It Rains More During the Early Morning and Late Afternoon. Halbert P. Gillette. p. 387-8.
27. Problems of the Distribution System. William J. Gray. p. 389-90.
28. Forms for Filtration Plant Reports. Committee on Purification Data and Forms of the Water Purification Division, Am. W. W. Assoc. p. 398-9.
29. Determining the Efficiency of a Distribution System. Meyer Serkes. p. 400-2.
30. *Water Works Engr'g*, Vol. 83, 1930.
31. How a Typical Rural Community Supplied Itself With Water. Lewis V. Carpenter. No. 23, Nov. 5, p. 1647-8.
32. Public Swimming Pools—Their Relation to Water Works. Arthur M. Crane. No. 23, Nov. 5, p. 1649-50, 1688.
33. Essential Points in Prospecting for City Ground Water Supplies. Howard E. Simpson. No. 23, Nov. 5, p. 1651-2.
34. How the Water and Fire Departments May Cooperate. George A. Nelson. No. 23, Nov. 5, p. 1660.
35. Early N. Y. Water History Linked With Bank Charter. No. 23, Nov. 5, p. 1671-2, 1675.
36. *How to Increase Efficiency of Water Purification Plants. H. W. Streeter. No. 23, Nov. 5, p. 1680, 1687-8.
37. When Is the Water Works Liable for Damages From Shutting Off Supply. Leo T. Parker. No. 24, Nov. 19, p. 1715-16, 1742, 5, 6.
38. Municipal Water Softening—The Many Advantages From Its Adoption. Charles P. Hoover. No. 24, Nov. 19, p. 1717-18, 1741.

Should a Community Retain a Consulting Engineer When Planning for Incineration?

(Continued from page 34)

weeded out and selection made of those which it is worth while visiting samples of. By following out this preliminary study of the bids, much valuable time can be saved during the period allotted to the

inspection trip. It is of course preferable that the plants visited should be operating in towns that have many characteristics in common with the community which is planning to build the plant.

If the inspection trip is to be most valuable, three to four hours should be afforded for each plant visited. The following list may be of assistance in determining what to look for on the trip.

1—General Data Concerning:

- (a): The population figures and class or type of community.
- (b): The nature and quantity of refuse destroyed.
- (c): The ability of the plant visited to meet the specifications which governed its construction.
- (d): The compatibility of the specifications for the plant visited with the specifications of the plant contemplated.

2—Construction Data Concerning:

- (a): The quality and workmanship in the building and equipment.
- (b): The present condition of the plant—and how it has resisted wear and tear.
- (c): The total maintenance costs required since the date of building.

3—Operating Data Concerning:

- (a): The hours and labor required to dispose of the rated capacity.
- (b): The ability of the plant visited to meet overloads adequately.
- (c): The opinion of surrounding home owners as to nuisance and odors.
- (d): The opinion of the operators and public officials as to the efficiency of the plant.
- (e): The appearance of the ashes going to the dump and already on the dump.

Information obtained on the inspection trip should aid in deciding which is the most desirable of the proposals offered. After this has been accepted it becomes necessary to incorporate in the contract those items which appear in the contractor's specification but which were not specifically mentioned in the original sheet of specifications and blue prints as prepared—a technical matter of much importance.

From the time the contract is signed and work commenced, frequent inspection and close supervision is a vital need. Costly time losses and other miscellaneous losses, to both the contractor and the taxpayer, can be avoided by skilled supervision, which should continue under the authority of one responsible man throughout the progress, finishing, final testing and subsequent acceptance of the work.

Even the most excellent and suitable incineration system depends on the operators for its success, and it is advisable, therefore, to maintain full-time supervision over the whole system until perfect co-ordination has been obtained and the personnel have been thoroughly trained.

The many factors involved in the planning of the system, in the preparation of the city's specifications and in the selection of the most desirable bid, are for the most part technical in nature, and require considerable time and attention. If the community has in its employ a man competent to handle the details involved it is of course unnecessary to employ a consulting engineer. But if, as is generally the case, no such man is already available, a skilled consulting engineer may save the governing body much concern and annoyance, and insure to the taxpayers an intelligent conservation and application of the money which must be invested. Many of the foremost contractors in incineration work are equipped with an excellent engineering service, but in almost every instance it is desirable that the municipality have its own expert upon which it can rely for impartial decisions and sound judgment.

The Development of Sand-Asphalt Roads

(Continued from page 23)

are thoroughly mixed and heated to not less than 180° F. or more than 250° F. They are then mixed with the asphalt, which has been heated to not less than 300° F. or more than 375° F. This asphalt mix is hauled to the road in trucks and spread before it has cooled to a temperature below 150° F.

Spruce planks are laid on the subgrade true to line and grade, and fastened securely so that they will not be displaced when the mixture is being spread and rolled. The spreading is usually done by hand from a steel dumping platform, so that all of the mix is turned over and spread in a uniform fashion. After it has been properly spread and raked, it is rolled as soon as it will bear the roller without any undue displacement or hair-cracking. Delay in initial rolling is forbidden and it usually follows within fifty feet behind the placing. The mix is placed in two layers, the base being 2½" after compaction, and the top course 2" after compaction, making a total thickness of 4½" compacted. By placing the mixture in two courses, all irregularities of the subgrade are found and checked in the first layer, so that with the final layer a surface especially true and even can be obtained. Furthermore, these roads are almost invariably built under traffic, one-half the roadway being constructed at a time, and the two-layer method permits rapid work so that there is a minimum interruption to the traveling public.

The greatest care is taken in the inspection of the work, and material that shows itself to be non-uniform in the least degree is promptly rejected. The simplicity of the operation is such, however, that with careful control very little rejection occurs. The same mix is used for both bottom and top layers. In cuts or on steep grades, the gutters are paved with the same mix and thoroughly tamped in place. Run-off gutters at the ends of cuts are made of the same material and carried down over the embankment to prevent erosion. Samples of the mix are sent regularly to the state laboratory and tested with the Hubbard-Field stability machine, in addition to careful and continuous testing of the mineral aggregates and asphalt.

With the use of high-speed trucks, central plant set-up can be made and operation to a number of jobs several miles apart can be carried on simultaneously. Jobs with eight-mile haul are not uncommon.

At the present time there are 177 miles of this type of construction on the state highway system, and 337 miles on the township roads which are supervised by the state authorities. For the year ending 1929, the average cost of maintenance per mile was \$58.05, a square yard cost of less than ½ cent. Practically the only maintenance required is an occasional very light seal coat using 85 per cent asphaltic oil covered with clean sand, or the occasional repair of a small area where the subgrade has settled. During 1929, the total material used for such repair on 177 miles of pavement was 9½ tons. The contract price of construction averaged for 1930 approximately \$5.00 per ton complete in place. This would run approximately \$20,000 per mile for 24 ft. width. Roads of this type carry as high as 15,000 vehicles a day. For township roads, lesser width and lesser thickness are entirely adequate and vary according to local traffic conditions. In cases where reduction in thickness is made, it is essential that the top course shall not be less than 2" in depth

in order to prevent shoving, any lessening in thickness being obtained by using a thinner base.

Roads of this type are non-skid, and, with modern day construction, especially smooth and easy driving. They take care of heavy traffic conditions; may be widened easily and rapidly as traffic increases, and with their long life and very low maintenance, make an ideal highway where sand is abundant.

Acknowledgment is made for information received from R. W. Coburn, construction engineer, and H. C. Holden, district engineer, in regard to the history and development of the type.

Garbage Disposal in Small Municipalities

Names of thirty small municipalities, eleven of under three thousand population, which incinerate their garbage; and of thirty others that feed it to hogs.

CONSIDERABLE interest has been shown in the article which appeared in our December issue giving a synopsis of information obtained by us regarding refuse disposal methods in about twelve hundred small municipalities. The information, if all published, would have occupied so much space—even a list of the names of the municipalities—that it did not seem to us desirable to give more than the abstract which we did. However, several have written us asking for further information concerning some of the features, and it seems probable that a more definite statement concerning incineration and hog feeding would be of interest to many.

The municipalities were all, with a very few exceptions, of four thousand population or less, as of the U. S. Census of 1920. Some of them have undoubtedly grown beyond the four thousand limit since then, but probably not so much so as to no longer be classed as "small." In the following lists, the figures following each name give the population in thousands by the 1920 census.

Incineration

The following reported the use of incinerators for destroying garbage: Tuscumbia, Ala.—3.8; Fort Lauderdale, Fla.—2.1; Fort Pierce, Fla.—2.1; Glencoe, Ill.—3.4; Rockport, Ind.—2.6; Crystal City, Mo.—2.2; Atlantic Highlands, N. J.—1.6; Highlands, N. J.—1.7; East Rockaway, N. Y.—2.0; Patchogue, N. Y.—4.0; Tuckahoe, N. Y.—3.5; Euclid, O.—3.4; Wyomissing, Pa.—2.1; Lubbock, Tex.—4.0; Mercedes, Tex.—3.4; Snyder, Tex.—2.2; Hopewell, Va.—1.4; Follansbee, W. Va.—3.1; Hinton, W. Va.—3.9; Lovell, Wyo.—1.7. Among some of over 4,000 population, but still small, are Ft. Thomas, Ky.—5.0; New Boston, O.—4.8; Munhall, Pa.—6.4; Vandergrift, Pa.—9.5; Kingsport, Tenn.—5.7; Electra, Tex.—4.7; Marlin, Tex.—4.3. Also River Forest, Ill.—4.4, and State College, Pa.—2.4, burn rubbish in incinerators.

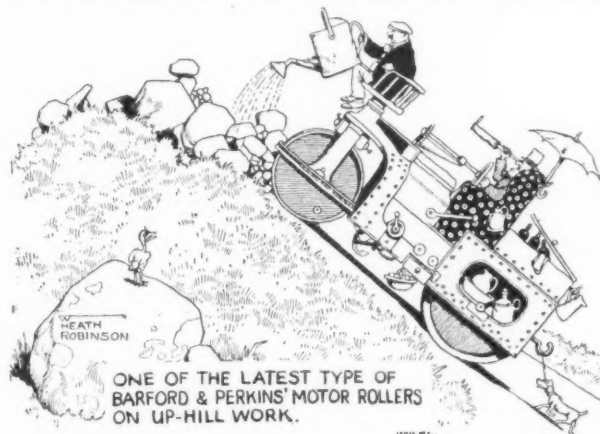
It is possible that some reporting incinerators have only crude, home-made appliances. On the other hand, of the several score which report that they burn their garbage (none of which was included above) there may be several which use incinerators.

Hog Feeding

A full list of the small municipalities whose garbage is fed to pigs is difficult to obtain. A great many report that all or part of the garbage is taken by farmers, whether for feeding to pigs or not, is not stated and perhaps not known. Also several hundred report that the removal is attended to by the individual householders, and it seems probable that many of these arrange with farmers for its collection. Quite a number, however, stated definitely that the garbage is fed to pigs. Among these were the following: Claremont, Calif.—1.7; El Segundo, Calif.—1.6; Colusa, Calif.—1.8; Fullerton, Calif.—4.4; La Verne, Calif.—1.7; Lodi, Calif.—4.8; Ventura, Calif.—4.3; Kenilworth, Ill.—1.2; Ligonier, Ind.—2.0; Nappanee, Ind.—2.7; Clear Lake, Ia.—2.8; Mt. Vernon, Ia.—1.5; Hays, Kans.—3.2; Westport, Mass.—3.1; Belding, Mich.—3.9; Birmingham, Mich.—3.7; East Lansing, Mich.—1.9; Robbinsdale, Minn.—1.4; N. Mankato, Minn.—1.8; Aurora, Neb.—3.0; Manasquan, N. J.—1.7; Clayton, N. M.—2.2; Oberlin, O.—4.2; Oak Harbor, O.—1.9; Jefferson, O.—1.5; Okemah, Okla.—2.2; Hillsboro, Ore.—2.5; North East, Pa.—3.5; Pulaski, Tenn.—2.8.

Humor in English Advertising

The English have been accused by Americans of having no sense of humor. It is beginning to dawn on us that this is not the case; in fact, they even introduce humor into their advertisements, as is evi-



denced by the illustration, reproduced from an advertisement in an English engineering periodical. Concerning it the advertisers say:

"The above drawing is by that celebrated master of humour, Mr. W. Heath Robinson. Our Roller has been cleverly satirized without departing from fact throughout, and we make no apology for advertising in such a manner what is generally regarded as a prosaic article for road-building. A world lacking humour would be a poor place to live in.

"Our Motor Rollers are designed to work fully loaded up an incline of 1 in 7 with cast-iron wheels and 1 in 5 if steel plated rings are fitted, a fact taken advantage of by the artist. We further consider the comfort of the driver by fitting an upholstered seat, not quite as elaborate as the one shown. Those who are familiar with the Roller will remember many things considered necessary by the driver, as creature comforts, no more impossible than those the artist has depicted."

ble horn, and for this reason this type is limited in its application. It has the disadvantage of being the cause of noise and creating some ridicule.

Light Actuated Signals are actuated by the inter-

ruption of the light rays passing to a light-sensitive tube, and for night operation requires the installation of a light over-head to provide the rays, the interruption of which will actuate the signal.

Costs of Grade Crossings

Eighty-four per cent of the total fatalities on highways occur at railroad grade crossings, of which there are 250,000 in the United States. The elimination of these is one of the important considerations for highway planners.

Morris Goodkind, bridge engineer of the New Jersey Highway Commission, has worked out a comparison of the costs of each of several types of overhead crossings over single and double-track, or spanning 17 ft. and 30 ft. respectively. In his estimates he has estimated dry excavation at \$2 a yard, concrete at \$25, structural steel at 8 cts. a pound, and creosoted timber at \$120, and obtained the following costs:

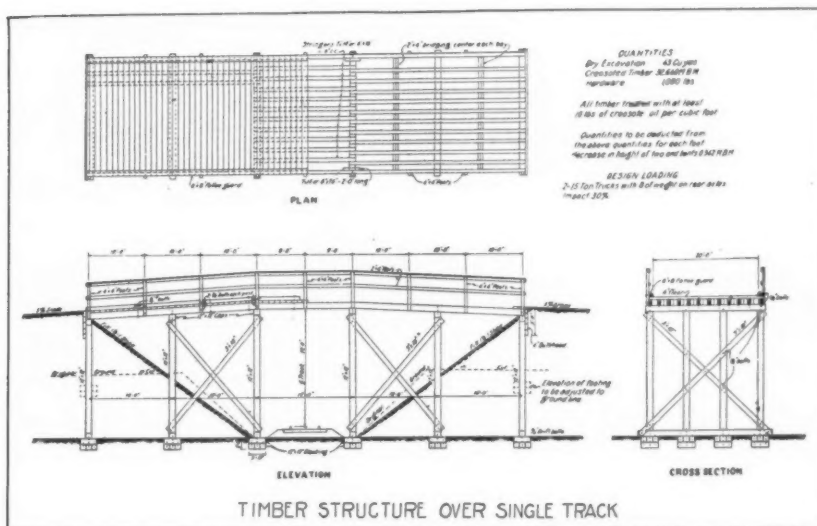
	Over Single Track	Over Double Track
Timber structure	\$4,469	\$6,841*
Steel structure	8,073	8,845
Concrete structure	10,206	11,052

*With steel span.

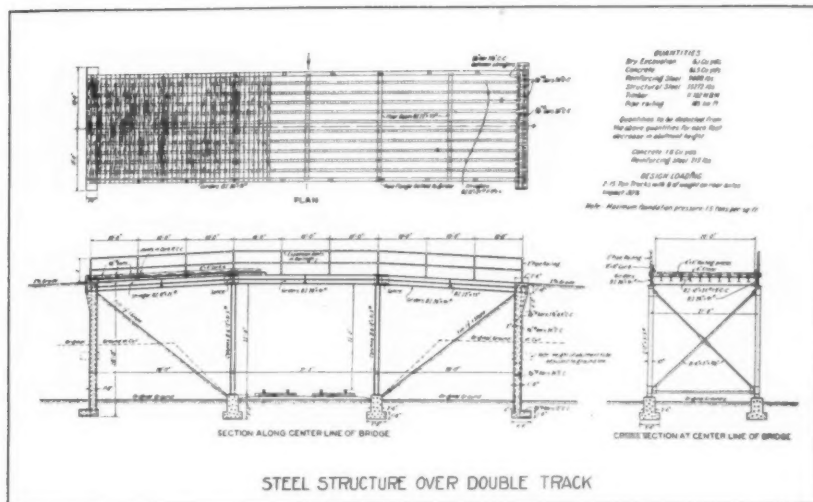
These estimates are based on standard plans; with abutments designed as self-supporting in simply supported trusses, but in rigid frame designs the abutment is supported against thrusts at the top as well as at the foundation.

In addition to the main structure, there must be an approach at each end, which decreases in length as the tracks fall below the level of the ground at the beginning of the approach, becoming zero when the depth of the railroad cut equals the clearance required under the bridge. In some cases a relocation of the approaches so as to cross at a deeper cut will reduce the total cost. In very flat country, however, it is generally best to build the structure at the site of the existing crossing. The approaches may be wholly of embankment or partly embankment and partly trestle, depending upon the relative cost of the two under local conditions, including cost of borrowing earth and extra width of right of way for the embankment.

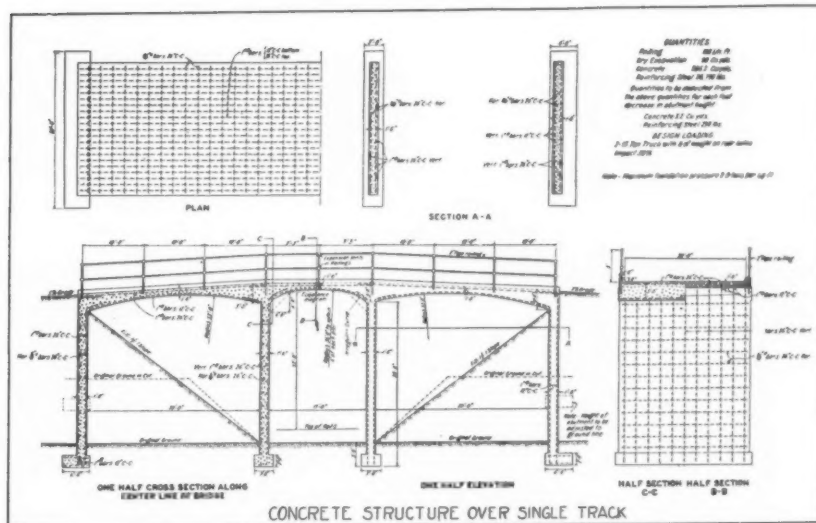
Instead of an overhead crossing, an underpass may be used in some cases; but it is generally more expensive, for the bridge must then carry the heavy railroad loads, a temporary structure must be built to carry the trains while the permanent structure is being built, and drainage of the underpass may present considerable difficulty.



Standard plan for timber structure over single track.

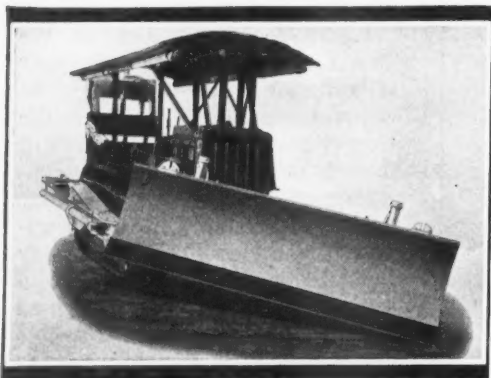


Standard plan for steel structure over double track.

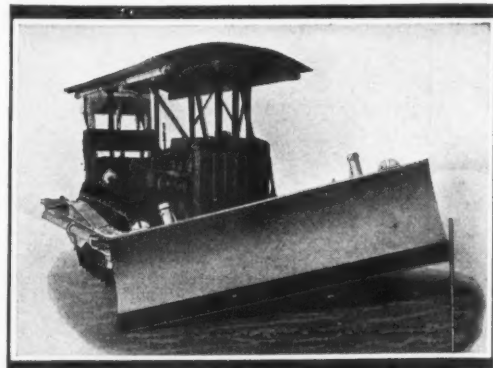


Standard plan for concrete structure over single track.

Snow Removal and Construction Equipment



The LaPlant-Choate backfiller with oscillating blade is designed for use with Caterpillar tractors. It will operate economically under adverse conditions. The LaPlant-Choate hydraulic control is used.



LaPlant-Choate Backfiller With Oscillating Blade

The LaPlant-Choate Mfg. Co., Cedar Rapids, Ia., has brought out an improved backfiller for use with Caterpillar tractors. Some of the outstanding improvements include a newly designed blade pivot box which allows the blade to oscillate freely at all times; a much shorter blade; a moldboard with an improved roll; a special side-swing; and a mushroom shoe which will carry the blade level even when the tractor is running in ruts.

This equipment is supplied with the LaPlant-Choate hydraulic control, and with a center pivot mounting which makes it possible to put the entire weight of the backfiller on the tractor, when desired, thus making it instantly portable.

Light Snow Plows for Passenger Cars or Light Trucks

Light snow plows which may be used on passenger cars or light trucks, which can be attached in a few minutes, are made by The Empire Plow Company, Cleveland, Ohio.

There are three different models for three different purposes, each one offering the dealer a market never before reached by snow removal equipment.

The "Auto Snow Shovel" is a light, straight blade plow which can push the snow straight ahead or to either side and can be carried on the bumper of the car from one job to another. Made

exclusively for smooth surfaces and low speeds, it is an inexpensive, easily handled plow which can be stored along the wall of any garage.

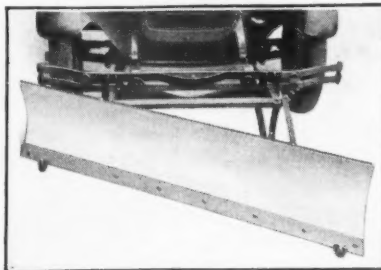
Recommended for filling stations; parking lots; schools and colleges; loading platforms of warehouses, wholesale houses, etc.; driveways; estates, etc.

The V-81 Auto Snow Plow is a heavy duty "V" plow which can be operated by passenger cars or light trucks. It has road-grader steel blades and is in fact a smaller edition of the larger, heavy road and street plows. The V-81 is required wherever deep snows are encountered and for roads and streets which would be too rough for the Auto Snow Shovel, and for continuous heavy usage.

Recommended for townships and municipalities, larger cemeteries and estates, schools and colleges, other institutions where the grounds are large or the snow condition severe, real estate developments, etc.

The Speed Plow is designed for the purpose of enabling cars and trucks to travel over roads that otherwise would be impassable.

Snow that is higher than the axle stops automobile travel, and it is this snow that the Meyer Speed Plow is designed to remove. It does not touch the ground but is carried on the car like a bumper. It rides axle-high, with the result that the snow above the axle is easily and speedily removed, making a path free for the auto to travel.



Three different models of Empire snow plows are provided. Left, the Meyer speed plow; center, the No. 78 auto snow shovel; and right, the V-81 heavy duty snow plow.

Caterpillar Adds "30" Wheel Grader

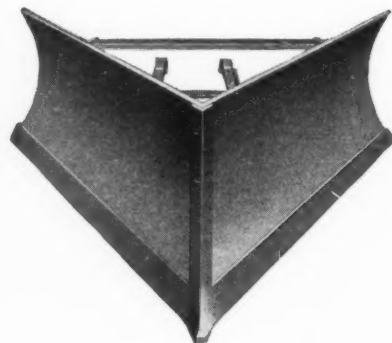
The immediate success of the "Caterpillar" leaning wheel Sixty grader has caused the Caterpillar Tractor Co. to add a "Thirty", giving two leaning wheel graders to this road building line.

In spite of the fact that the leaning wheel "Sixty" has been in production for some months now, the Minneapolis Factory has been unable to catch up with orders.

Snow Plows.—The Good Roads Machinery Co., Inc., Kennett Square, Pa., have issued leaflets covering their 23-B snow plow and backfiller, and Models 16-C and 18-C snow plows as adaptable for use with the Allis-Chalmers Industrial tractor, Case "Model C" tractor, and McCormick-Deering Model 10-20 four wheel tractors.

Sand Spreader.—The Good Roads Machinery Co., Kennett Square, Pa., have issued a 4-page booklet describing the Good Roads Sand Spreader, which is suited to a wide variety of uses.

Snow Plows.—The Baker Mfg. Co., Springfield, Ill., has published a complete and valuable catalog on snow plows for use with motor trucks and tractors. A large number of types of plows are illustrated, and data are given regarding the conditions for which each type is fitted.



News From the Engineering Field

American Road Builders' Association

The 28th annual convention of the American Road Builders' Association will get under way with the opening session Monday, January 12, in charge of President W. A. Van Duzer. Thos. H. MacDonald, chief of the United States Bureau of Public Roads, will speak at this session. At the same time the road show will be opened to delegates and visitors.

President Stanley Abel of the County Highway Officials' Division will open the county sessions Monday afternoon, and two other sessions at that time will hear reports of general committees, one being the report on highway finance and administration.

Tuesday morning will have the meetings on highway location, airport drainage and surfacing, the motor freight session, a newcomer to the Road Builders' programs, and the first session for contractors.

President C. E. Myers, of the City Officials' Division, will open the City Officials' session on Tuesday afternoon. Contractors and county officials will meet again, and there will be a general committee report on construction and maintenance methods for low cost roads and bridges.

There will be four general committee sessions Wednesday morning, including subgrades and pavement bases, snow removal and equipment, grading methods and grading equipment, and standardization of methods for purchasing equipment.

Wednesday afternoon will have continued sessions of both the city and county officials.

President M. A. Coroalles of the Pan American Division will lead the Pan American session Thursday morning, which will hear the conclusions and recommendations of the committee reports presented in Spanish, and talks on various subjects of particular interest to that group. Two general committees will hold sessions to hear the reports on central and transit mixed concrete, and highway guard rail.

The City, County and Manufacturers' Divisions will hold their final sessions and business meetings Thursday afternoon. There will be a business meeting of the American Road Builders' Association and a meeting of the co-operating committees of the Road Builders' and the American Association of State Highway Officials.

The Manufacturers' Division, of which Paul L. Griffiths is president, will hold its first meeting on the previous Saturday, January 10.

Institute of Traffic Engineers

Representative traffic engineers of the United States have founded a national organization, the Institute of Traffic Engineers, to further the interests of the profession. Ernest P. Goodrich, Con-

sulting Engineer of New York, is President. Other officers are: Dr. Miller McClintock, Director of the Albert Russel Erskine Bureau for Street Traffic Research of Harvard University, Vice-President; and Hawley S. Simpson, Research Engineer, American Electric Railway Association, New York, Secretary-Treasurer. Burton W. Marsh, Traffic Engineer of the City of Philadelphia and Guy Kelcey, Manager, Traffic Engineering Division of the American Gas Accumulator Company of Elizabeth, New Jersey, were elected to the Board of Managers. Headquarters are to be at 175 Fifth Avenue, New York.

The next meeting of the Institute will be held in New York in January, 1931, at the time of the annual meeting of the American Society of Civil Engineers.

Associated General Contractors of America


Albert P. Greensfelder of St. Louis, and William A. Starrett of New York have been nominated as president and vice-president, respectively, of the Associated General Contractors. The nominations are tantamount to election. They will succeed Anton E. Horst of Philadelphia and James E. Cashman of Burlington, Vt.

American Society of Municipal Engineers

The name of the American Society for Municipal Improvements has been changed to the American Society of Municipal Engineers. The personnel of officers and membership remains the same.

K. W. Grimley, formerly assistant sanitary engineer of the Jefferson County, Ala., Board of Health, has been appointed director of the newly formed Bureau of Health Education and Publicity of the Board of Health. Dr. J. D. Dowling is health officer for Birmingham and Jefferson County. Mr. Grimley has been with the Board since his graduation from Alabama Polytechnic Institute in 1923, as assistant engineer on rural sanitation, mosquito control and water supply.

Walter H. Gahagan, head of W. H. Gahagan, Inc., contracting engineer of Brooklyn, N. Y., died Dec. 18. Mr. Gahagan attended the Ohio State Technical School and the Massachusetts Institute of Technology. Early in his career he was engineer for various St. Louis firms and subsequently built seven bridges over the Snake and Red Rivers in Arkansas. He was in charge of the construction of the Manhattan pier of the Williamsburg Bridge. In 1899 he started in business for himself. Two of his sons, William and Frederick, were associated with him.



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—CONSTRUCTION COSTS ARE LOW—



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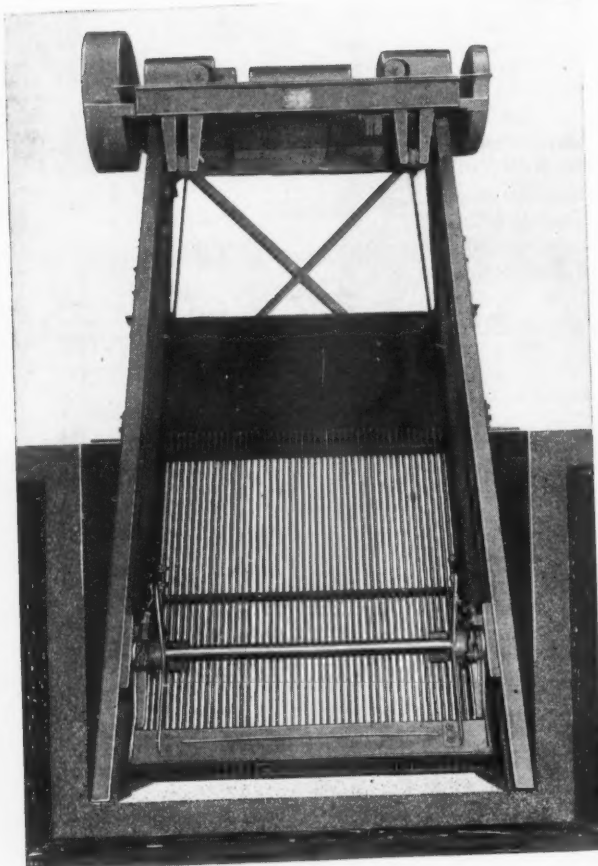
Write for descriptive folder and prices

TRAFFIC & STREET SIGN CO.

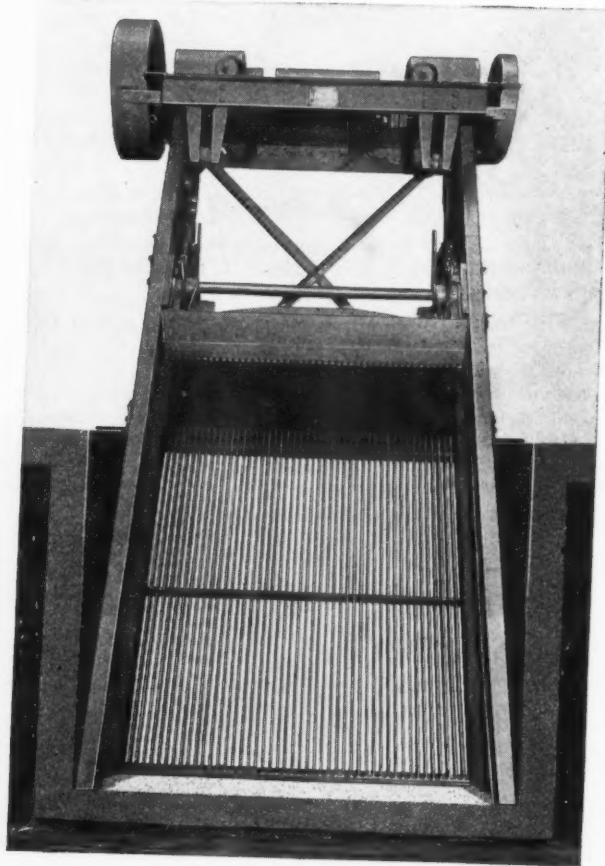
86 Foundry St., Newark, N. J.

STRAIGHTLINE BAR SCREEN

The Modern Screen for the Modern Plant



Showing rake at bottom ready to start cleaning screen bars.



Showing rake at top ready to return.

CONTINUOUS automatic removal of screenings from bar screens is a necessity in a modern sewage plant.

EVERY four minutes the accumulated screenings are brought up by the rake of the **STRAIGHTLINE** Screen and dumped into a trough or conveyor.

The rake is held free of the bars as it returns to the lower end of the screen to start another cycle of removal of refuse.

The control equipment used for the back and forth travel of the rake, is the same time-tried, dependable, simple and durable device that is used for the Link-Belt Skip Hoist; and can be varied for cycles of four minutes up to one hour, to suit conditions.

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For latest catalogs—consult the *classified* INDUSTRIAL LITERATURE section, beginning on page 99

Money Saving Methods

A Cast Iron Sewer With Vic-taulic Joints

By M. H. Hutchinson

A particularly interesting cast iron sewage installation coupled with Vic-taulic joints was completed by the city of Houston, Tex., in 1927. This line was constructed as replacement for a tile line.

A difficulty presented in installation was the necessity for spanning a bayou. A concrete support was built with a bed of sand. It was necessary to transport the 2600-pound pipe lengths about 400 feet. For this work an old gun



Laying the Houston sewer.

caisson was obtained. By rigging chains and suitable hooks, the pipe was slung under the gun carriage, and wheeled out on the shoulders of the concrete support.

It is of interest to note that the entire line was laid at the rate of four joints per hour by one white foreman, 7 negroes and three Mexican laborers. The Victaulic couplings were installed in rapid time and on the first test the line was found to be absolutely tight.

The pipe was cast with shoulders on all ends to receive the couplings. (All pipe mills are prepared to supply this type of end at practically the same cost as bell and spigot pipe.)

Filling Expansion Joints Full With One Pouring

Some contractors on New Jersey Highway construction have found that the tar filler poured into expansion joints sunk slowly into the joint, and continued to settle, finally practically disappearing. In such cases, it was

necessary to go over the entire job re-filling the joints.

The trouble was diagnosed in the *Elbee Tatler*, published by Littleford Brothers, as being due to the use of filler not hot enough to penetrate to the bottom of the joint immediately. Instead it settles slowly due to its own weight, necessitating later refilling of the joint. In cool weather, even though the material in the asphalt kettle is kept at 350 or 400 degrees, it chills rapidly as it is carried in the kettle to the point of application, and spouted in a thin stream into the joint.

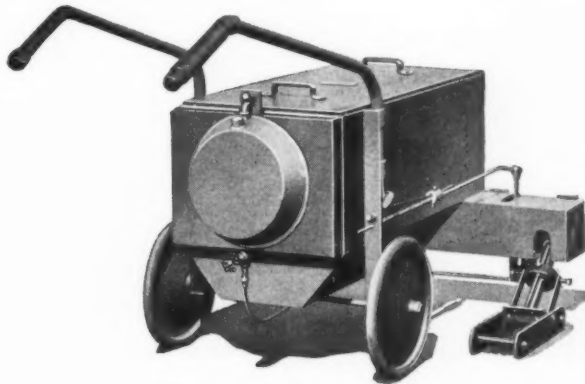
The remedy recommended is to maintain an adequate degree of heat until the filler is in the joint. The new Littleford joint filling machine is fitted with a set of burners which keep the material warm; heat is applied directly above the nozzle.

Insley Mast Hoist With Smith Mixers on Unusual Tunnel Job

An unusual installation of an Insley Mast Hoist plant with two T. L. Smith 28-S mixers in connection with a tunnel—unusual because of the method of application as well as economies effected by its use—was made on the H. W. Rohl and Company Figueroa Street Tunnel job in Los Angeles, California.

As shown in the photograph the portal of the tunnel is on a side of the hill with a very limited area for carrying on operations. There was almost a perpendicular drop of forty feet which allowed the contractor to install a 300 ton, 5 compartment steel bin. Under this bin was mounted a weighing box and under the weighing box two new one-yard T. L. Smith mixers were installed.

Inasmuch as the contractor, Mr. Rohl, owned an Insley Mast plant and equipment, he figured out a method to use this Mast plant and spouting to deliver his mixed concrete at a considerable saving over the use of a concrete gun which ordinarily would be required under similar circumstances.



The Littleford joint filler.



Using an Insley hoist.

His plan was to dig a small tunnel above the regular tunnel, thus allowing him to chute his concrete well in towards the center of the tunnel.

The project consists of three fairly short tunnels, each one approximately 450 feet long.

In the photograph it will be noticed that the guys on the left hand side of the mast are at a very steep angle. This is due to the fact that the Southern Pacific freight yards adjoin the job and in addition a high tension power line runs close to this set-up.

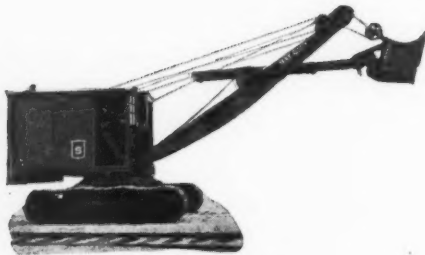
Reducing Maintenance Costs on Snow Plow Equipment

A county road commission in Michigan has been experiencing considerable difficulty in keeping its snow plow equipment in good shape during long, severe winters. In removing the heavy snowfall from the highways, road plows operated by tractors are used. The abrasive action of the ice and packed snow quickly wears down the tractor treads, and as the cost of replacement with new treads for heavy tractors is well over \$500, some means of lengthening their life is highly essential.

A solution to this problem has been found in the application of Haynes Stellite to the treads. This hard surfacing material is a non-ferrous alloy, composed mainly of cobalt, chromium, and tungsten. It is extremely resistant to abrasion, and is very easy to apply

to practically any surface receiving undue wear. Each cleat of the tread was hard faced in four places. Each tread consisted of 58 cleats, so treated; and the total cost, including the Haynes Stellite, oxygen, acetylene, and labor amounted to less than 7 per cent of the replacement cost. After such hard surfacing, treads on tractors have been operated for a greatly increased period of service.

Equipment for Construction Economy



Bay City shovel.

New Bay City Shovel

Bay City Shovels, Inc., Bay City, Michigan, announces an addition to its line of convertible power shovels and cranes. The new Model S Bay City is a full-revolving convertible power shovel with full-crawler mounting and enclosed steel cab, with gasoline, oil engine, or electric power. It weighs 63,000 pounds equipped as a shovel. Capacity is rated as a full one-yard shovel or excavator or a seventeen ton crane (at 12' radius).

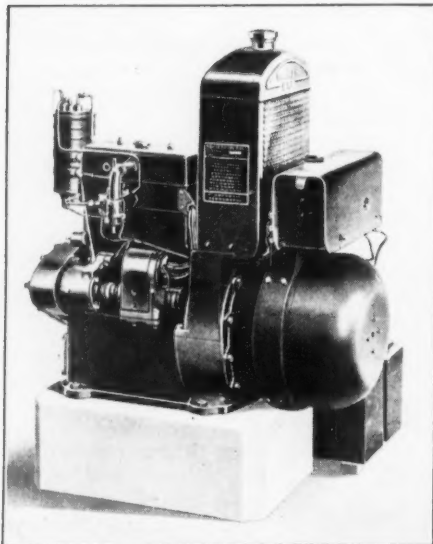
Model S is furnished with shovel, dragline, trench hoe, clamshell or crane boom attachments, all of which are convertible.

It is powered by Climax "Blue-Streak" 6" bore, 7" stroke gasoline engine. Shovel boom is 21 ft. long with chain crowd and cast manganese dipper. Crane booms 35' to 60' in length. Crawler tread width 22". Ships without dismantling.

A 2-Inch Humdinger Pump

The new 2 inch Humdinger Self-Priming Centrifugal pump manufactured by the Ralph B. Carter Company of 192 Atlantic Street, Hackensack, New Jersey, is designed especially for contractors.

Extreme overall dimensions on the



New Koehler double duty plant.

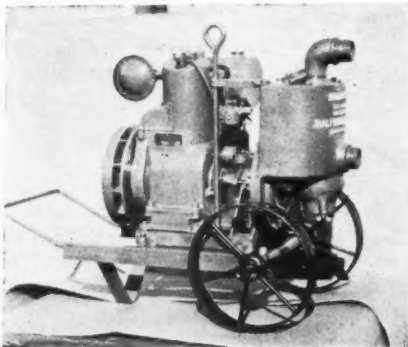
standard outfit of length 28", width 11" and height 25", make it just about the most compact piece of pumping equipment of anywhere near its capacity.

Capacities up to 7,500 G.P.H. are obtainable under certain conditions. On average contractors' work, however, capacities of approximately 6,000 G.P.H. are usual.

For the contractor whose dewatering requirements do not warrant a large pump this is an ideal outfit. It may be had mounted either on a two wheel hand truck as shown or skidded.

New Double Duty Electric Plant

A combination service—current for a number of lights, without operating, and power for heavy duty from the gen-



2-inch Humdinger Pump.

erator after the plant has been started automatically—is offered by the new model D-32 Kohler electric plant, just announced by the Kohler Co., Kohler, Wis.

This new power unit meets special needs on yachts and railroads, and in camps, resorts, and farm homes. Its service provides that a few lights can remain burning for long periods with-



Bay City dragline.

out starting the plant. From seven to twelve 25-watt lamps can be turned on and still current is delivered most economically.

The new plant has a capacity of 1½ K. W. With the engine running it operates motors up to 2 H. P.

For Small Ditching Work

The great amount of hand work required in digging ditches for laying small pipe has brought about the development of the "Little Goldigger" by the C. H. & E. Division of National Equipment Corporation, Milwaukee.

Designed and developed to dig a trench from 3 inches to 6 inches wide, the C. H. & E. Goldigger has a wide utility range for digging gas service connections, high pressure gas lines, small oil pipe lines, ornamental lighting cables, telephone cables, sprinkling and drain pipes in golf grounds and airports, and in any other underground work that requires a trench up to 6" in width and 48" in depth.

Digging speeds vary from one to six feet per minute. Two speeds are available without changing sprockets and 36 speeds may be had by changing sprockets. Full multiplane traction with very low ground pressure permits operation on wet soil without miring.



This C. H. & E. trencher digs ditches 3 to 6 inches wide.

INDUSTRIAL LITERATURE

Describing Materials and Equipment for Constructing, Operating and Maintaining Public Improvements

You can obtain the catalogs listed on this and the following pages by using the form at the bottom of this page or by writing to the Company direct, giving the catalog number and mentioning PUBLIC WORKS.

Construction Methods and Equipment

Accessories, Motor Truck

1. Truck accessories—winches, power take-offs, derricks, special bodies, earth boring machines, and trailers of all capacities are described in a series of folders issued by the Four Wheel Drive Auto Company, Clintonville, Wisconsin.

Asphalt Heaters

8. A 54-page booklet issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describes and illustrates oil, wood and coal burning asphalt and tar kettles, tool heaters, sand dryers, tool boxes, traffic line markers, grout mixers, asphalt tools and their use in road construction.

9. "Hotstuf," the master oil burning heater, is the only heater with patented elevated melting chamber for Asphalt, Tar and all bitumens used in road and street construction and maintenance, roofing, water proofing, pipe coating, etc. Described in illustrated manual No. 11—Mohawk Asphalt Heater Co., 94 Weaver St., Schenectady, N. Y.

Asphalt Plants

10. J. D. Farasey Mfg. Company, Cleveland, Ohio, issue a booklet for use and specifications for Farasey Portable Asphalt Paving Plants. These R. R. 1-car plants have easy capacity of 2,250 yards, 2" surface per 8 hours. Cheap to operate.

Asphalt Rollers

12. A 16-page booklet printed in two colors gives full details and specifications of the Erie Roller. Also explains how to use it to save tamping costs. Numerous action pictures. Issued by the Erie Machine Shops, Erie, Pa.

Chip Spreaders

25. The Universal Road Machinery Company of Kingston, N. Y., have issued a booklet describing their Reliance Chip Spreader, a special trailer, operating in the reverse direction, designed for resurfacing bituminous highways. Spreads to a width of 8' to any desired thickness.

Concrete Accelerators

30. "How to Cure Concrete," a forty-seven page manual published by the Dow Chemical Company, Midland, Michigan, treats fully the subjects suggested by its title. A well-illustrated and instructive volume.

31. "Curing Concrete Roads with Solvay Calcium Chloride," 30 page booklet. Comprehensive. Contains tables, illustrations, suggestions for testing devices. Covers the subject in considerable detail. Published by the Solvay Sales Corp., 61 Broadway, New York, N. Y.

Concrete Curing

34. "Concrete—Its Manufacture and Use," a complete treatise and handbook

on present methods of preparing and handling portland cement concrete. National Equipment Corp., Milwaukee, Wis. Koehring Division.

Concrete Mixer

41. Booklet illustrating features and use of the 27E Heavy Duty paving mixer for concrete highway and pavement construction. National Equipment Corp., Milwaukee, Wis. Koehring Division.

43. Koehring "Dandle" concrete mixers in 5S, 7S and 10S size are described fully in new illustrated catalog published by the National Equipment Corp., Milwaukee, Wis. Koehring Division.

44. Concrete Mixers. A 32-page booklet published by the Jaeger Machine Co., 400 Dublin Ave., Columbus, Ohio.

Concrete Placing

45. Placing concrete with chutes from steel towers and mast hoist plants is described fully in a 95-page booklet that gives valuable information to the construction man. National Equipment Corp., Milwaukee, Wis. Insley Division.

Crushers

56. Pioneer Gravel Equipment Manufacturing Company, Minneapolis, Minnesota, publishes complete 80-page manual, showing blue print sketches of set-ups in pit or quarry of the eleven different sizes of Pioneer Crushing Plants.

57. Up-to-date information on Stone Crushers, Stone Spreaders, Unloaders, Drags and other contractors' equipment from the Gallion Iron Works & Mfg Co., Gallion, Ohio.

59. A new booklet has just been issued by the Universal Road Machinery Company of Kingston, N. Y., describing their full line of portable and stationary crushing, screening and washing units.

Drag Lines

61. Write for complete catalog on Pioneer Drag Line. Catalog shows cross section of Drum Unit with full description of Frame, Sheaves, Motor and Bucket.—Pioneer Gravel Equipment Mfg. Co., Minneapolis, Minn.

Drills

66. "Jackhammer" Drills are built in six sizes. The 27-lb. BAR-33, is recommended for soft rock, concrete, etc.; the 75½-lb. DDR is recommended for the heaviest and roughest work. Intermediate sizes meet other drilling conditions the world over. Full information on use in bulletin 4146. Ingersoll-Rand Co., 11 Broadway, N. Y.

Dump Wagons, Spring Wind-Up

68. Bulletin W-30-J, just issued by Western Wheeled Scraper Company, Aurora, Illinois, illustrates and explains the new Western Automatic Spring Wind-up with which all Western Crawler dump wagons, either new or in service, can be equipped without requiring any attachment on the tractor. This device makes the employment of a wagon man unnecessary.

Dump Wagons, Steel

70. Steel Dump Bodies and hydraulic hoists for Fords and other small trucks are described and fully illustrated in technical literature published by the

Wood Hydraulic Hoist and Body Co., 7924-60 Riopelle St., Detroit, Mich.

71. "Steel Dump Bodies." Full data on steel dump bodies for every type of hauling proposition and description of special "Self-Dumper Bodies" for road Builders. Wood Hydraulic Hoist and Body Co., 7924-60 Riopelle St., Detroit, Mich.

Hoists, Truck

85. "Dump Truck Hoist." Double the Truck's value by using power operated Hydraulic Hoists. Catalog of WOOD Hydraulic Hoist and Body Company, Detroit, Michigan, describes Hydraulic Hoists for every make and model of Truck.

Hoppers, Measuring

86. The C. S. Johnson Co., Champaign, Ill., publish a booklet which describes the Johnson Demountable Bins and Measuring Hoppers. Data sent on request.

Hose and Belting

87. Complete information on rubber hose and belting for all types of contracting and road building service available from the Government Sales Department of the Goodyear Tire & Rubber Co., Inc., Akron, Ohio.

Lanterns and Torches

90. Send for interesting catalog in colors of Diets Lanterns and Road Torches adapted for night traffic warning on any construction work that obstructs the highways. R. E. Diets Co., 60 Laight St., New York, N. Y.

Loaders and Unloaders

96. Portable car unloaders save money for the contractor on road and other construction projects. Full information on this and on the Reliance Chip and sand spreader on request. Universal Road Machinery Co., Kingston, N. Y.

97. Link-Belt Company, Philadelphia, describes a line of Portable Loaders and Unloaders in Folders: Nos. 1073 and 1074 cover Belt Conveyors with channel iron and truss types of framework; No. 1076. Portable Bucket Elevators for different classes of work; and No. 1149, the "Grizzly" Crawler Loader for heavy work and large capacities.

Motor Trucks

107. "Trucks for Federal, State, County and City Governments," a booklet issued by Dodge Brothers, division of Chrysler Corporation, gives information about company's trucks in municipal, county, state and government activity.

108. Four-wheel-drive trucks to increase the range of truck operation and for economy of operation for use in road building and maintenance, described in a series of new folders just issued by the Four Wheel Drive Auto Company, Clintonville, Wisconsin.

Paving Materials

111. "Tarvia Double Seal Pavements." Shows, step by step, the construction of a Tarvia pavement. Profusely illustrated with photographs, 24 pages. The Barrett Company, 40 Rector Street, New York.

Plows

112. Plows, Grade Rippers (Scarifiers) and Scrapers are fully illustrated in a new



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Three Times *the* Mileage with **ROAD DELAYS** **PRACTICALLY ELIMINATED**



THREE times as many buses as they operated in 1926! Three times the mileage, amounting to more than three million miles. And yet since Firestone Gum-Dipped Truck and Bus Tires were adopted by the Washington Railway and Electric Company, four years ago, road delays have decreased from 254 a year to a mere 27—*having been practically eliminated*. During this time the bus miles operated per tire failure have been increased from 7300 to 120,542—an increase of over 16 times the average of 1926.

Firestone



WHAT truly amazing evidence of the rapid strides that Firestone has been making in the improvement of Truck and Bus Tires! What eloquent testimony to the results which are being secured by Firestone's careful supervision of the use and care of its products—not for just a single year or two—but continuously over a long enough period of years to make a real test. And all this is but one of the many similar cases where owners of the country's largest fleets are depending on the Firestone Organization for more economical, less interrupted fleet operation. With Firestone Tires, Tubes, Batteries, Brake Lining and Rim equipment, you can profit by the broad experience of the Firestone Dealer, in the proper adaptation and care of your Truck or Bus equipment.

Specify Firestone Gum-Dipped Tires and Firestone Rims when purchasing new equipment.

TIRES - RIMS - BATTERIES - BRAKE LINING

catalogue which will be sent upon request by Wiard Plow Company, Batavia, N. Y. Oldest Plow manufacturers in America.

Power Graders

117. A large wall display piece, No. 3001, printed in three colors and containing a very large illustration of the Warco Model "E" power grader as well as complete descriptions on both center and rear control graders will be sent by the W. A. Riddell Co., of Bucyrus, Ohio, to anyone interested.

Pumps, Contractors'

119. 'Domestic' Contractors' Pumps. Automatic Priming, Ball Bearing Centrifugals 2½" to 6" sizes. 'Giant' Road Pumps, 80 and 100 gallons per minute. Dependable Diaphragm and Plunger Trench Pumps and Hoists. Special Bulletins. Domestic Engine & Pump Co., Shipensburg, Pa.

122. Humdinger contractors' pumps. Diaphragm pumps in both the open discharge and the diaphragm force pump types. Self-priming Centrifugal pump, for automatic continuous prime on suction lifts up to 28'. Are described fully and valuable practical information for contractors is given in special Bulletins #107-A and 103-A. Ralph B. Carter Co., 53 Park Place, New York, N. Y.

Road Construction

123. "Road Construction and Maintenance" are covered in a new Cletrac Booklet, which takes up such subjects as modern methods of handling large capacity equipment, tandem equipment, etc. Cleveland Tractor Co., 1932 Euclid Ave., Cleveland, Ohio.

Road Rollers, Scrapers, Graders, etc.

125. Plows, Grade Rippers (Scarifiers) and Scrapers are fully illustrated in a new catalogue which will be sent upon request by Wiard Plow Company, Batavia, N. Y. Oldest Plow manufacturers in America.

127. A 16-page booklet printed in two colors gives full details and specifications of the Erie Roller. Also explains how to use it to save tamping costs. Numerous action pictures. Issued by the Erie Machine Shops, Erie, Pa.

128. A beautiful 32 page book in four colors featuring their entire line of road rollers has been published by the Buffalo-Springfield Roller Co. of Springfield, Ohio. 8½ x 11, leatherette cover, numerous action pictures.

131. 20-page pocket size booklet showing all types of Buffalo-Springfield motor rollers and scarifiers. The Buffalo-Springfield Roller Company, Springfield, Ohio.

132. "Road Machinery." A sixty-four page data book has been issued by the Austin-Western Road Machinery Company, 400 No. Michigan Ave., Chicago, describing their full line of road building machinery. Included in it are illustrations and descriptions of road graders, 5-foot blade to 12-foot blade; road rollers, steam or gasoline powered, 3 to 15-ton single cylinder to four cylinder. Motor graders, three sizes. Scarifiers. Crushing plant equipment, small road tools. Special bulletins on each separate piece of machinery supplement the general catalog.

133. "Road Rollers." New illustrated booklets covering the entire line of Master 4-Cylinder motor roller, 4-cylinder tandem roller and International motor roller. Gallon Iron Works and Manufacturing Co., Gallon, O.

134. 36-page, illustrated book describing mechanical features of Huber 4-cylinder Motor Roller and its application to many types of road construction and maintenance. Huber Mfg. Company, Marion, Ohio.

135. Road Machinery Illustrated. New illustrated bulletins on the master Motor Roller, Three-Wheel and Tandem Rollers, Motor Graders powered by Caterpillar, Twin City, Cletrac, McCormick-Deering

and Fordson tractors, and Straight and Leaning Wheel Graders. Gallon Iron Works & Mfg. Co., Gallon, O.

136. Full description of Huber Motor Rollers in sizes from 5 to 15 tons, included in durable 36-page book for use by road contractors and maintenance crews. Huber Mfg. Co., 345 E. Center St., Marion, Ohio.

137. The Autograder, Dreadnought and Motorgrader are described and illustrated in 2 colors in three bulletins just published by the Good Roads Machinery Co., Kennett Square, Pa.

Sand and Gravel Washing Plants

139. Up to date information on Portable Sand and Gravel Washing Plants with concrete capacities, ranging from 30 to 100 yards per hour.—Pioneer Gravel Equipment Mfg. Co., Minneapolis, Minn.

Screens

140. Full information concerning Shaker and Revolving Screens, Conveyors, Elevators, Bins and Chutes is contained in catalog and special illustrated folders on Pioneer line. Write Pioneer Gravel Equipment Mfg. Co., Minneapolis, Minn.

Shovels, Cranes and Excavators

141. Link-Belt Company, Chicago, in Book 1095, gives valuable information on Heavy Duty Crawler Cranes-Shovels-Draglines, ¾ to 2½-yard capacity, with full line of attachments—grab buckets, trench hoes, dippers, magnets, hook blocks, back-filler boards, grapples, pile drivers, etc.; also complete line of Locomotive Cranes and accessories.

142. The Cranemobile, "successor to Trench Cranes," an adaptation of the crawler mounted Bay City Tractor Shovel is fully described and illustrated in Bulletin C2 just issued by Bay City Shovels, Inc., Bay City, Mich.

145. Catalog K3 just issued, completely describes the light half yard and the full half yard convertible shovel, crane, dragline, trench hoe and skimmer manufactured by Bay City Shovels, Inc., Bay City, Mich. 28 pages, over 50 illustrations, action pictures and charts.

147. Complete specification catalogs on the Koehring No. 301, 401, 501 and 601 gasoline or electric shovels, cranes and draglines. National Equipment Corp., Milwaukee, Wis. Koehring Division.

151. The complete line of ¼-yd. to 1½-yd. shovels, cranes, draglines, ditchers and skimmers manufactured by the Orton Crane & Shovel Co., 608 S. Dearborn St., Chicago, Ill., is described in Bulletin 60, which also gives lifting capacities and working ranges for the different sizes and types of these crawling tread machines.

Steel Forms

155. A well illustrated catalog of Steel Forms for concrete road, curb and sidewalk construction is available from The Heltzel Steel Form & Iron Company, Warren, O.

Steel Bins

159. Steel bins and measuring hoppers are included in a fully illustrated catalog of Contractors Equipment issued by The Heltzel Steel Form & Iron Company, Warren, Ohio. Write for your copy.

Steel Posts

160. Steel Posts for all purposes. Sweet's Herculean Steel Posts for highway guard rails, fences and other purposes. Catalog and data book. Sweet's Steel Company, Williamsport, Pa.

Tires, Truck and Car

165. Solid, cushion and pneumatic tires and tubes for trucks, cars, tractors, graders and other road machinery. Full information and data available from Government Sales Department of the Good-year Tire & Rubber Company, Inc., Akron, Ohio.

Tool Trailer

167. Mohawk Hi-Speed Tool Trailer—a rugged tool box 7' long 3' wide, 2' high

with sliding tray made of 10, 12 and 14 gauge steel, mounted on two rubber tired wheels. Drop the tools in, lock it, and hook it to a truck and your tools are there when you want them. Write for circular. Mohawk Asphalt Heater Co., 94 Weaver St., Schenectady, N. Y.

Tractors, Crawler

169. Cletrac crawler tractors. Cleveland Tractor Co., 1932 Euclid Ave., Cleveland, O. Bulletin 562 describes their use in roadbuilding and maintenance, earth moving, excavating, grading, snow removal, oil field work and lumbering. Made in "20," "30," and "40" and "100" sizes.

170. "Roads," a series of five fully illustrated folders, prepared by the Caterpillar Tractor Co., of San Leandro, Calif., and Peoria, Ill., shows what Russell graders and "Caterpillar" tractors can do and are doing to build better roads quicker and cheaper.

171. The design, construction, details and complete specifications of the new Ten and Fifteen models "Caterpillar" are given in a booklet recently published by the Caterpillar Tractor Co. of San Leandro, Calif., and Peoria, Ill.

173. Cletrac Crawler Tractors are built in a complete line by The Cleveland Tractor Company, 19322 Euclid Ave., Cleveland, Ohio. Cletracs range in size from the 12 h. p. model to the powerful 100 h. p. tractor.

Tractors, Wheel

175. "Huber Tractors" and "The Huber Motor Rollers." Illustrations of machines in operation and testimonials from users. The Huber Mfg. Co., 345 E. Center St., Marion, Ohio.

176. "Kerosene Power, the Low-Price Road Builder," book of data by the International Harvester Co., 606 So. Michigan Ave., Chicago, shows economy of kerosene tractors. Illustrations, specifications and figures on cost of operation.

Truck Cranes

182. Full-revolving, gasoline-operated Truck Cranes with a capacity of 7½ tons at a 10 ft. radius, for mounting on a 5-ton or 7½ ton auto-truck, are described in Bulletin 62, issued by the Orton Crane & Shovel Co., 608 S. Dearborn St., Chicago, Ill.

Truck Hoists

183. "Dump Truck Hoists." Double the Truck's Value by using power operated Hydraulic Hoists. Booklet published by WOOD Hydraulic Hoist and Body Company, 7924 Rloppelle St., Detroit, Michigan, describes Hydraulic Hoists for every make and model of Truck.

Wheeled Scoops

190. The Warco wheeled scoops, claimed to offer the most economical handling of earth on short hauls, is fully described and illustrated in bulletin N. 3002, issued by the W. A. Riddell Co., of Bucyrus, Ohio. Printed in three colors and fully illustrated—will be sent to anyone interested.

Road and Street Maintenance

Asphalt, Heaters

200. For general construction and maintenance, the Original Improved "Hotstuf" Asphalt Heater, an economical oil burning heater. A new bulletin, 4 pages, 6½ x 10. The Mohawk Asphalt Heater Company, 94 Weaver St., Schenectady, N. Y.

201. Tar and Asphalt Kettles, Oil Burning Kettles, Pouring Pots, Torches and Hand Spraying Attachments. Full data. Connery & Company, Inc., of Philadelphia.

202. Connery & Company, Inc., 3900 N. Second St., Philadelphia, Pa., has issued a new Bulletin "J" describing the latest and improved style "J" Oil Burning Kettle for Paving Contractors, Street and Highway Departments.

SWEET'S STEEL POSTS

Available in ten standard lengths varying from 5 to 9½ feet in length and in four standard weights.



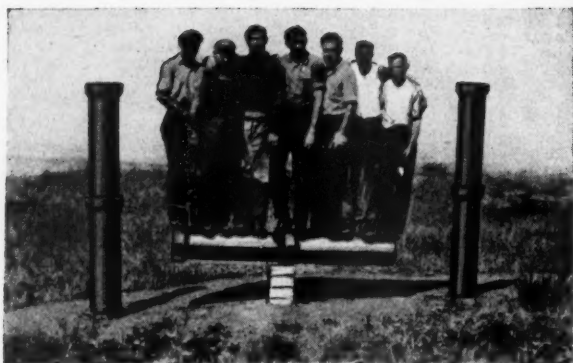
No separate parts are required to attach fencing—adaptable to any type of wire fencing.

SWEET'S STEEL COMPANY

Write for Descriptive folder.

Williamsport, Pennsylvania

EX XL CELL



Sewer Pipe Joint Compound

**Makes permanent water tight,
acid-proof joints and saves
money, time and labor.**

Ex-XL-cell Sewer Pipe Joint Compound is prepared from carefully selected asphalts and acid-proof fillers, compounded and manufactured to rigid specifications. Made in large batches, raw materials and finished products are thoroughly tested before being approved for shipment.

The most modern machinery for compounding, blending and handling, together with long experience and careful attention, gives a perfect seal and assures the engineer of a material giving satisfaction under all conditions.

Savings—Some of the many recognized savings demonstrated through the use of

ex-XL-cell Sewer Pipe Joint Compound have been:

1 In the ability to specify smaller pipes in construction due to assurance that the full capacity of pipe is always available by prevention of infiltration at joints.

2 Tree roots, cannot enter joints and cause breakage or filling of pipes.

3 Flexibility and adhesion are retained, allowing joint to conform to pipe movements, where

trench settling or soft fills are encountered.

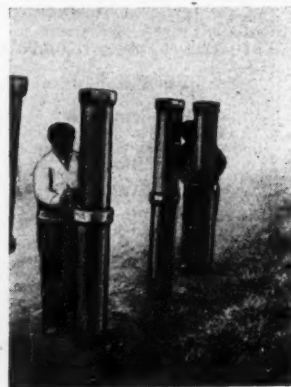
4 Trenches may be back filled at once as compound sets immediately.

5 Strong acids and alkalis, so much a part of sewerage, have no effect on ex-XL-cell.

6 Two or three joints may be poured outside of the trench, and lowered in trench as a unit thereby reducing labor in restricted space of trench.



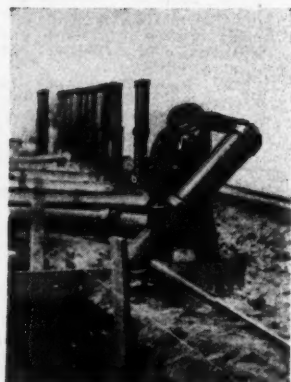
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203. A 54-page booklet issued by Littleford Bros., 452 E. Pearl St., Cincinnati, Ohio, describes and illustrates oil, wood and coal burning asphalt and tar kettles, tool heaters, sand dryers, tool boxes, traffic line markers, grout mixers, asphalt tools, etc.

Bituminous Distributors

205. Complete details regarding performance and construction of the Good Roads Champion Distributor are presented in an attractive book published by the Good Roads Machinery Co., Kennett Square, Pa., 50 pages; 26 illustrations.

Cold Asphalt Equipment

207. Spreaders and other inexpensive maintenance equipment adapted to use BITUMULS described in a 70-page manual on BITUMULS furnished on request by the American Bitumuls Company, 503 Market Street, San Francisco, or 4200 O'Donnell Street, Baltimore.

Dust Control

210. "How to Maintain Roads," by the Dow Chemical Company, Midland, Michigan, is a manual dealing thoroughly with dust control, road building and maintenance. It contains tables and composition, grading, etc.

211. "Dust Control," a concise, handy pocket reference on control of dust by use of 3C Calcium Chloride. Illustrated. Issued by the Columbia Products Company, Barborton, Ohio.

Dust Laying

213. Solvay Sales Corporation, New York, supplies full information regarding the use of Solvay Calcium Chloride for effectively laying dust. The booklet, "Solvay Calcium Chloride, a Natural Dust Layer," 24 pages, 5½x8, covers application, economies, etc. Sent without cost.

Equipment

215. "Road and Street Maintenance Equipment," a compact vest pocket manual containing illustrations and brief descriptions of their extensive line, has just been issued by Littleford Bros., 452 East Pearl St., Cincinnati, Ohio.

216. "Light and Heavy Road Maintenance" is the title of a recent folder showing the tremendous power developed by the FWD truck and its economy for use in pulling road graders and maintainers—issued by the Four Wheel Drive Auto Company, Clintonville, Wisconsin.

Road and Paving Materials

Cold Asphaltic Pavement

225. The construction of Durable and Non-skid asphaltic pavements with cold asphaltic cement described with specifications and tables in a fully illustrated 70-page free hand book on BITUMULS published by the American Bitumuls Company, 503 Market Street, San Francisco, or 4200 O'Donnell Street, Baltimore.

Concrete Curing

235. "How to Cure Concrete," is a manual of instruction on the curing of concrete pavements. A handy, useful volume, well illustrated. 47 pages, 5½x7½. The Dow Chemical Company, Midland, Mich.

Culverts, Large Diameter

237. The advantages of pipe culverts over open type bridges, and the latest approved practice of including detour, maintenance and operating costs in the total cost of a road or bridge project, are explained in the 16-page illustrated bulletin, "Applying Culvert Simplicity to Highway Bridge Requirements," issued by the Armcu Culvert Mfrs. Association, Middletown, Ohio. Write for a copy of Bulletin H-31.

Culverts, Cost Comparisons

238. A 24-page illustrated booklet, "Selecting Culverts and Drains on the Basis of Cost per Year," reviewing the factors which, collectively considered, permit true cost comparisons between structures serving the same purpose, has been published by the Armcu Culvert Mfrs. Association, Middletown, Ohio. Bulletin H-34 will be sent free on request. Write for it today.

Culverts, Full Circle

239. "Looking into GOHI Culverts," a complete booklet on Gohl corrugated cul-

verts is now ready for distribution. It contains much valuable information regarding Gohl culverts and their installation. Issued by the Gohl Culvert Mfrs., Newport, Ky.

Culverts, Half Round, Flat Bottom

240. Detailed data sheets and circulars on the installation of Gohl half round, flat bottom culverts. Also full information regarding their adaptability for certain uses. Prepared by the Gohl Culvert Mfrs., Newport, Ky.

Culverts, Perforated

241. Complete information concerning the use and adaptability of Gohl perforated culverts is now available. Published by the Gohl Culverts Mfrs., Newport, Ky.

Maintenance Materials

268. Road and street maintenance and reconstruction with BITUMULS Cold Asphaltic Binder described in an illustrated paper by C. H. Thomas, Maintenance Engineer. Reprints furnished by American Bitumuls Company, San Francisco or Baltimore.

270. "How to Maintain Roads," by the Dow Chemical Company, Midland, Michigan, is a manual dealing thoroughly with road building, maintenance and dust control. It contains tables of composition, grading, etc.

272. Preservation of Streets and Roads by the use of Road Oil, with many illustrations and testimonials from users. The Standard Oil Co. of Indiana, Chicago.

273. "Stanolind." Stanolind Paving Asphalt, a compound prepared by the Standard Oil Co. of Ind., is described in minute detail in booklet, "Stanolind." Standard Oil Co. of Indiana, Chicago.

275. "Tarvia-K. P. for Cold Patching." An instructive booklet illustrating and describing each step in patching a road with "Tarvia-K. P." 16 pages, illustrated, 3½x9. The Barrett Company, New York.

276. "Road Maintenance with Tarvia." A 56-page illustrated booklet of value to every road man. Shows how almost every type of road and pavement can be repaired and maintained with Tarvia. The Barrett Company, New York.

277. "Tarvia." An attractively illustrated 32-page booklet describing grades of Tarvia and showing photographs of actual application. The Barrett Company, 40 Rector St., New York City.

Traffic, Street and Warning Signs

297. Data on "Early" street signs and sign posts. Describes adjustable method of fastening frame to staff, and illustrates porcelain enamel and other plates. Traffic and Street Sign Co., Newark, N. J.

Garbage and Refuse Disposal

305. "Pittsburgh-Des Moines Incinerator," built and guaranteed by the Pittsburgh-Des Moines Steel Company, 79 Neville Island, Pittsburgh, Pa., is described fully in a booklet sent on request.

Snow Removal

Snow Removal

348. "Winter Maintenance" is the title of a recent booklet issued by the Four Wheel Drive Auto Company, Clintonville, Wisconsin. Illustrates many types of snow plows and methods of handling snow removal problems.

349. "The Answer to the Snow Removal Problem" is the title of a new booklet just published by Carl Frink, Mfr., of Clayton, N. Y. It gives full details of the new Frink type S snow plow for trucks.

350. The W. A. Riddell Co., successors to Hadfield-Penfield Steel Co., Bucyrus, Ohio, has just issued new literature describing Fordson Snow Removers and Hadfield-Penfield One-Man Graders.

353. Efficient methods of combating quickly the snow menace on highways and city thoroughfares. Illustrates joint use of crawler tractors and standard and special snow plows. The Cleveland Tractor Co., 19322 Euclid Ave., Cleveland, Ohio.

354. "Snow Removal Equipment," a colorful booklet just off the press of the Caterpillar Tractor Co., of San Leandro, Calif., and Peoria, Ill. Various types of snow-fighting equipment built for "Caterpillar" Tractors are pictured in relief and in action.

356. Good Roads Champion Snow

Plows are fully described and illustrated in several attractive bulletins just issued by the Good-Roads Machinery Co. of Kennett Square, Pa. Specify whether you are interested in blade or "V" type, for truck or tractor and whether for heavy or light duty.

358. The new Type "S" Frink Snow Plows and Frink Leveling Wings, together with complete data for selecting the proper size snow plow for your particular make and model of truck. Published by Carl H. Frink, Clayton, N. Y.

359. Callon Iron Works and Mfg. Co., Gallon, Ohio, will gladly furnish details, prices and catalogs of their snow plows adaptable to any make of truck.

Sewerage and Sewage Disposal

Inlets and Manhole Covers

400. Cast iron sewer blocks, ventilators, manhole covers and inlets, valves, etc., described in pamphlet by the South Bend Foundry Co., South Bend, Ind.

Jointing Materials

401. G-K Compound for vitrified clay sewers, MINERALEAD for bell and spigot water mains, also M-D Cut-Ins for making house connections, described in catalogue of Atlas Mineral Products Company, Mertztown, Pennsylvania.

Odor Control

404. For information and booklet on control of odors at sewage treatment plants, write Wallace & Tiernan Co., Inc., Newark, N. J.

Pipe, Vitrified

405. Full information regarding Vitrified Pipe and other heavy clay products. Illustrated price list on application. Factories in Pennsylvania and Ohio. The Progressive Clay Co., offices in New York City, Philadelphia, Pa., and Syracuse, N. Y.

Septic Tanks

411. Septic Tanks made of Copper-Bearing, Rust-Resisting Iron—all seams extra heavy welded, are described and illustrated in a folder published by the manufacturers, Mohawk Asphalt Heater Co., 94 Weaver St., Schenectady, N. Y.

Sewage Screens

414. The Dorr Co., 247 Park Ave., N. Y., publishes Bulletin No. 6391, which describes the construction and operation of the Dorrco Mechanically-Cleaned Bar Screen.

415. Link-Belt Company, Philadelphia, shows in Book 642 its line of sewage screens (Tark, Brunotte, and Straight-line) for fine and coarse sewage: Straightline Collectors for Settling Tanks (Sludge, Scum and Grit; and Mechanical Aerators for activated sludge plants.

Sludge Bed Glass Covers

418. Sludge Bed Glass Covers—"Super-Frame" Hitchings & Co., Main Office, Elizabeth, New Jersey. Offer A. I. A. File 101SB, Describing glass covers for sludge and sprinkler beds.

Sludge Bed Glass-Overs

421. The use of Lord & Burnham sludge bed Glass-Overs at Dayton, Ohio, are described in Subject No. 10. There are 11 Glass-Overs, each 60 feet wide and 163 feet long, covering 2½ acres. Lord & Burnham Co., Graybar Bldg., New York.

422. The use of Lord & Burnham sludge bed Glass-Overs at the Highland Park, Ill., sewage treatment plant are described in Subject No. 11. This is one of the smaller of the eight sewage treatment plants on the Chicago North Shore. Lord & Burnham, Graybar Bldg., New York.

423. Sludge Glass-Overs at Fostoria, Ohio, are described in Subject No. 14. At this plant the sludge removal carrier is supported directly on the roof construction. Lord & Burnham Co., Graybar Bldg., New York.

424. The Sludge Glass Overs at the Bloomington and Normal, Ill., plant are described in Subject No. 15. The plant serves a population of 54,000. A sludge bed area of 0.774 square feet for maximum estimated population is provided. Lord & Burnham Co., Graybar Bldg., New York.

Treatment

425. Dorr Company, 247 Park Ave., New York, in its Sanitary Engineering bulletin describes the use of its equipment for treating municipal sewage, industrial wastes and water. Photos of numerous

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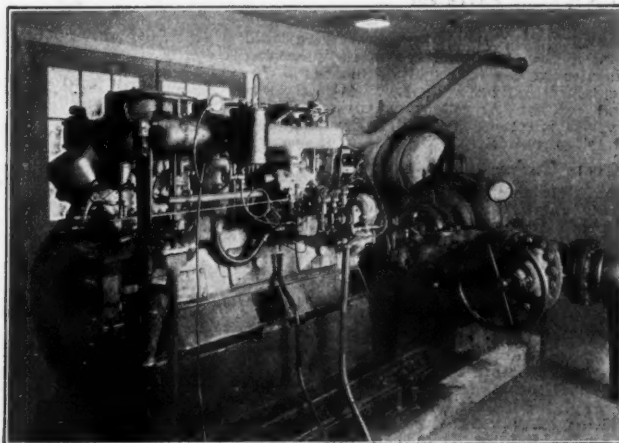
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operating plants are shown as well as representative flow sheets illustrating the various methods of sewage treatment.

427. The Pacific Flush Tank Company, of Chicago and New York, publish eight separate catalogs on Sewer and Sewage Disposal Automatic Equipment, including pumps, Imhoff Tanks and Sewer Joint Compounds. These are of real value to the designer or operator of a treatment plant.

428. Advantages of Liquid Chlorine for disinfection given in booklet issued by the Electro Bleaching Gas Co., 9 East 41st St., New York.

429. Chlorine is being extensively used in the disinfection of sewage not only as a disinfectant but as an aid to other purification processes. Wallace & Tiernan Co., Inc., Newark, N. J., have a publication, No. 42, on the chlorination of sewage, which will be sent to any address on request.

430. The Dorr Co., 247 Park Ave., N. Y., publishes Bulletin No. 6171, which describes the treatment of sewage with Dorr Traction Clarifier, an improved type of continuous sedimentation for use in water and sewage treatment plants.

432. The Dorr Company, 247 Park Ave., N. Y. C., publishes Bulletin No. 6481, which describes the construction and operation of the Dorr Detritor for continuously removing and washing the grit from sewage flows.

434. Automatic, continuous vacuum filters, producing a relatively dry cake of sludge in demand for fertilizer, are used by: Milwaukee, Houston, Chicago, Gastonia, N. C., Charlotte, N. C., write for literature, Oliver United Filters, Inc., Federal Reserve Bank Bldg., San Francisco, Calif.

Water Works Equipment

Aeration and Diffusion Plates

465. A complete booklet describes Norton Porous plates for activated sludge treatment plants, and for other sewage and water uses; also other shapes of fused alumina. Booklet includes data regarding chemical and physical characteristics, and tables published by Norton Co., Worcester, Mass.

Chlorination

470. Chlorine and Chemicals for purification of water and disinfection of sewage with description of Pennsylvania Salt Manufacturing Company's facilities for supplying these cheaply. Booklet, 15 pages, 3 1/2 x 6. Widener Building, Philadelphia.

471. Wallace & Tiernan Co., Inc., Newark, N. J., have just published a new technical publication, No. 74, describing chlorine control apparatus for the sterilization of the water supplies of small communities. Copy will be sent on request.

Couplings and Tees

485. Copper pipe for water works services and patented connections for jointing to corporation stops, iron pipe, etc. Full data 22 pages 8 1/2 x 11. The Mueller Co., Decatur, Ill.

Gate Valves

490. Double disc, fully bronze mounted Columbian Gate Valves are fully described and illustrated in a 6-page bulletin issued by the Columbian Iron Works, Chattanooga, Tenn.

Hydrants

504. Fire hydrants, modern and improved are illustrated and described in a two color folder recently issued by the Columbian Iron Works, Chattanooga, Tenn.

505. "Mathews" Fire Hydrants. Gate Valves and other water works appurtenances. 16 pages, 7 1/4 x 10 1/4. R. D. Wood & Co., Philadelphia.

506. Hydrants, tapping apparatus, gate locks, valves and curb cocks described in a series of bulletins issued by A. P. Smith Mfg. Co., East Orange, N. J.

Hydrant Extensions

510. Hydrant extension sections for use in Columbian hydrants already installed are briefly described in a handy folder issued by the Columbian Iron Works of Chattanooga, Tenn.

Meter Boxes

525. Efficient installation and maintenance of water meters is described in catalog issued by H. W. Clark Company, Mattoon, Ill., manufacturers of Meter Boxes, Coupling Yokes, Meter Testers, Service and Valve Boxes.

526. An illustrated catalog covering meter boxes and specialties such as gate valve housing, curb boxes, meter testers, melting furnaces, jointing materials, four-in-one pumps, has recently been published by the Hydraulic Equipment Co., Reading, Pa.

Pipe, Cast Iron

534. "Sand-Spun," Centrifugal cast iron pipe manufactured by R. D. Wood & Co., Philadelphia, is fully described in a valuable 16-page 6x9 booklet, containing also complete specifications of this pipe. No engineer or water works official should be without this booklet.

535. Cast Iron Pipe and Fittings, sizes 1 1/4 through 12 inches, either with or without Precaulked lead joints factory-made in the bells. Data book sent free. The McWane Cast Iron Pipe Co., Birmingham, Ala. and Provo, Utah.

536. "Weights and dimensions of Cast Iron Pipe and Fittings." A handy reference book for Municipalities and Contractors. 48 pages, 7 1/2 x 10 1/4. R. D. Wood & Co., Philadelphia.

537. "Universal Cast Iron Pipe," for water supply, fire protection and sewage disposal. All jointing materials eliminated. Machined iron-to-iron joints made with wrenches only. (Booklet). The Central Foundry Company, 420 Lexington Ave., New York, N. Y.

538. "High Pressure Fire Protection Lines." Booklet containing excerpts from Underwriters report, on Universal Cast Iron Pipe. The Central Foundry Company, 420 Lexington Ave., New York, N. Y.

539. U. S. Cast Iron Pipe Handbook contains useful tables and data for the Water Works man on pipe line construction. Issued by U. S. Cast Iron Pipe and Foundry Company, Burlington, N. J.

Pipe, Cement Lined

540. Steel or Wrought Iron Pipe lined with cement and special lead-lined joints, manufactured by the Cement Lined Pipe Co., of Lynn, Mass.

Pipe for Subdrainage

549. A revised 16-page well illustrated bulletin, "Increasing the Efficiency of Roadbed Drainage," containing information on the newest developments in the application of subdrainage to highway, municipal and public works construction—including frost boil prevention, landslide control and airport drainage. Ask for Bulletin H-30. Armco Culvert Mfrs. Association, Middletown, Ohio.

Pumps, Deep Well

565. A new type of centrifugal pump is described in an illustrated booklet just published by Layne & Bowler, Inc., of Memphis, Tenn.

Pump Packing

575. "When Power Is Down," by the Sterling Engine Company, Buffalo, N. Y., gives recommendations of models for standby services for all power requirements.

Service Boxes

578. "Service Boxes with Stay-on Covers. No more broken covers. No more lost covers." (Booklet). The Central Foundry Company, 120 Lexington Avenue, New York, N. Y.

Storm Sewers

579. A valuable 24-page, 6x9 illustrated bulletin for city engineers and officials, entitled "Planning Municipal Drainage for Today and Tomorrow," has been published by Armco Culvert Mfrs. Association, Middletown, Ohio. Sent to anyone interested free on request.

Swimming Pools

580. Wallace & Tiernan Co., Inc., Newark, N. J., have just published a new edition of technical publication, No. 41, dealing with the sterilization of swimming pools by liquid chlorine. Copy sent on request.

Tanks and Stand Pipes

582. A 50-page booklet issued by Pittsburgh Des Moines Steel Co., 79 Neville Island, Pittsburgh, Pa., on complete water works plants, elevated tanks, stand pipes and filtration plants built by them.

Tapping and Valve Machines

583. The A. P. Smith Company, of East Orange, N. J., furnish descriptive matter dealing with their many labor saving devices as the Smith tapping machine, valve inserting machine and pipe cutting machines.

Valve Boxes

590. "Standard," "Special" and "Type K" Valve boxes are all described and illustrated in a new bulletin recently published by the Columbian Iron Works, Chattanooga, Tenn.

Miscellaneous

Airport Construction

597. "Getting on the Air Map With 'Caterpillar'," profusely illustrated with action pictures, describes the many uses of the tractor in building and maintaining airports better, quicker, cheaper. Caterpillar Tractor Co., San Leandro, Calif., and Peoria, Ill.

Airport Drainage

598. "Building Safety Into Airports—with Efficient Drainage Construction," a 24-page well illustrated booklet outlining the requirements for airport drainage has been published by the Armco Culvert Mfrs. Association, Middletown, Ohio. A copy will be sent to those interested free on request. Ask for Bulletin C-2.

Asphalt Construction

605. Methods of mixing BITUMULS Cold Asphaltic Cement with natural soil or gravel for inexpensive landing areas and of constructing BITUMULS (cold) penetrated runways described in construction reports furnished by the American Bitumuls Company, 503 Market Street, San Francisco.

Community Advertising

610. Booklet showing various forms of publicity matter useful in arousing interest in the construction of small town water supplies. This matter is furnished free to Consulting Engineers and towns interested in waterworks construction by The Cast Iron Pipe Research Association, 566 Peoples Gas Bldg., Chicago, Ill.

Rules

625. The Luffkin Rule Company, Saginaw, Mich.; New York; Windsor, Canada. Manufacturers of Measuring Tapes, Boxwood Rules, Spring Joint Rules, Straight and Folding Steel Rules, Fine Mechanics Tools and Aluminum Folding Rules. General Catalog No. 11.

Sanitary Engineering

627. A Review of Sanitary Engineering Progress in 1929 listing here. Reprint from an article in Public Works showing the progress in Water Supply and Purification, Sewerage, Sewage Treatment, and Refuse Collection and Disposal, and listing important projects under way. Box 423, Grand Central Station, New York City, N. Y.

Tree Moving

632. "Tree Moving," folder from the Caterpillar Tractor Co., of San Leandro, Calif., and Peoria, Ill., shows and tells with action pictures and the letters of landscaping experts how to successfully move large trees.

New Catalogs

Not described before in the Industrial Literature Section.

35. "A report on Current Practice of using Calcium Chloride for curing Concrete Pavements, Building Construction, Bridges, Culverts and Concrete Products." Concise practical data, embodies latest information on subject. Issued by Columbia Products Co., Barberton, Ohio.

42. A 40-page booklet describing Smith 27-E paving mixer for highway construction, with data regarding mixer operation. Also Booklet 828, 72 pages, describing Smith mixers and pavers. National Equipment Corp., Milwaukee, Wisc.

81. Hoists of various kinds, single and double drum, small and large, and the C. H. & E. hoist for mast work are described in a series of booklets issued by the National Equipment Corp., Milwaukee, Wisc. C. H. & E. Division.

40. Bulletins NS23 and 329 describe the Smith Weigh-Mix for skip mixers, and for central mixing plants, respectively. National Equipment Corp., Milwaukee, Wisc.

61. Ditchers for all types of ditching and trenching jobs. National Equipment Corp., Milwaukee, Wisc. Parsons Division.

120. Triplex, diaphragm and centrifugal pumps for all types of construction work. National Equipment Corp., Milwaukee, Wisc. C. H. & E. Division.

126. Illustrated catalogs and descriptive material HERCULES All-steel, 6-cylinder road roller. 60 H.P. Gasoline engine. Sizes 5, 7, 8, 10, 12, and 15 tons. Three speeds forward and backward. Cast Steel rollers. The Hercules Company, Marion, Ohio.

Culverts, Corrugated

236. The added advantage in using Toncan Iron Culverts under highways for airport drainage, storm sewers, suburban allotments, etc., because of Toncan's alloy composition, is described in bulletin—"We are living in the Alloy age"—Toncan Culvert Mfrs. Association, Massillon, Ohio.

Expansion Joint for Pavements

250. Premoulded Expansion Joints in several different types, including a new asphalt rubber joint, in order to meet various construction conditions are covered in literature issued by the Serviced Premoulded Products, Inc., 53 W. Jackson Blvd., Chicago, Ill.

Rail Filler

281. Bituminous Rail Filler used for sound deadening, rail insulation and pavement protection is described in pamphlet issued by Serviced Premoulded Products, Inc., 53 W. Jackson Blvd., Chicago, Ill.

278. Information regarding crack and joint fillers furnished in gray, black, or other colors, for poured joints, also maintenance and repair work may be obtained by application to the Serviced Premoulded Products, Inc., 53 W. Jackson Blvd., Chicago, Ill.

Joint Materials, Sewer

403. A recent publication of the Serviced Sales Company, Monadnock Block, Chicago, Illinois, tells of the superior tightness, flexibility and durability of fibrated asphalt Sewer Pipe Belts and Joint Compounds. Complete instructions and considerable data are included in the pamphlet, now available.

Asphalt Bridge Planking

600. A new and improved asphalt composition has been developed as a long wearing and resilient paving material for bridges, viaducts, railroad platforms, etc., covered by Catalog No. 12, now available from Serviced Premoulded Products, Inc., 53 W. Jackson Blvd., Chicago, Ill.

Industrial Flooring

615. An extremely serviceable Fibrated Asphalt Industrial Flooring is one of the recent contributions to industrial efficiency. *Duo-Type Flooring*—interlocking sections with asphalt plank base and rubber block wearing surface offers a splendid combination of these products. Ask for pamphlets from Serviced Premoulded Products, Inc., 53 W. Jackson Blvd., Chicago, Ill.

Highway Crossings

612. A most serviceable and durable railroad crossing for city streets and main highways, is composed of fibrated asphalt planking and rail filler sections. Complete description and data will be furnished by Serviced Premoulded Products, Inc., 53 W. Jackson Blvd., Chicago, Ill.

Waterproofing Protection Course

640. Fibrated Asphalt Waterproofing Protection Course planks as now used for protection course to membrane waterproofing on railroad structures, viaducts, large roofs, etc., is described in Catalog No. 12, issued by Serviced Premoulded Products, Inc., 53 W. Jackson Blvd., Chicago, Ill.

When You Want Catalogs

Consult the

Industrial Literature Section

and use the coupon on Page 99

Index to Advertisements

Alvord, Burdick & Howson . . .	95	International Harvester Co. . . .	51
American Tar Prod. Co. Back Cover		Johnson Co., C. S.	60
Asphalt Institute	75	Link-Belt Co.	94
Atlas Mineral Products Co. . . .	80	Littleford Brothers	48
Babcock Brothers	95	Lord and Burnham Co.	11
Barrett Co., The Front Cover		Maddux Hotels	74
Barstow & McCurdy	95	Manger Hotel	76
Bay City Shovels, Inc.	90	McWane Cast Iron Pipe Co. . .	72
Black & Veatch	95	Metcalfe & Eddy	95
Bristol Hotel	74	Morrison Hotel	84
Brossman, Chas.	95	National Paving Brick Mfrs. Assn.	107
Buffalo-Springfield Roller Co. .	70	Oliver United Filters, Inc. . . .	85
Burns & McDonnell Eng. Co. . .	95	Orton Crane & Shovel Co. . . .	73
Caird, James M.	95	Owen Bucket Company	83
Carey Co., Philip	67	Pacific Flush-Tank Co.	84
Carter, Ralph B., Co.	90	Paramount Hotel	89
Cast Iron Pipe Research Ass. . .	14	Pearse, Greeley & Hansen . . .	95
Caterpillar Tractor Co.	65	Pennsylvania Salt Mfg. Co. . .	104
Cement Lined Pipe Co.	82	Piccadilly Hotel	93
Central Foundry Co.	82	Pioneer Gravel Equipment Mfg Co.	56
Clark Co., H. W.	82	Pirnie, Malcolm	96
Cleveland, H. Burdett	95	Pittsburgh-Des Moines St'l Co. .	89
Cleveland Tractor Co. 46 & 47		Pollock, Clarence D.	96
Cochrane Chemical Co.	102	Potter, Alexander	96
Columbian Iron Works	81	Progressive Clay Co.	80
Connery & Co., Inc.	90	Riddell Co., W. A.	69
Cramer, Robert	95	Robinson & Steinman	96
Cummer & Son Co., The F. D. . .	54	Serviced Products Co. 5 & 16	
Dietz Co., R. E.	63	Shoreham Hotel	89
Dixie Hotel	96	South Bend Foundry Co.	82
Dodge Brothers Div.	15	Standard Oil Co. of Indiana . .	59
Dorr Co.	7	Standard Oil Co. of N. Y. . . .	43
Dow & Smith	95	Sterling Engine Co.	100
Electro Bleaching Gas Co. . . .	76	Sweets Steel Co.	101
Erie Machine Shops	66	Toncan Culvert Mfrs. Assn. . .	9
Farasey, J. D., Mfg. Co.	90	Traffic & Street Sign Co.	93
Firestone Tire & Rubber Co. . .	100	U. S. Pipe & Foundry Co. . . .	79
Frink, Mfrs., Carl H.	10	Universal Road Mach. Co. . . .	6
Fuller & McClintock	95	Wallace & Tiernan Co.	18
Galion Iron Works & Mfg. Co. . .	3	White Co.	55
Gohi Culvert Mfrs. Assn.	13	Wiard Plow Co.	71
Goodyear Tire & Rubber Co. . . .	52	Williamsport Wire Rope Co. . .	12
Hazen & Everett	95	Wood Hydraulic Hoist & Body Co.	6
Headley Emulsified Prod. Co. . .	77	Wood, R. D., & Co.	78
Heltzel Steel Form & Iron Co. . .	77		
Hercules Co.	2		
Hill, Nicholas S., Jr.	95		
Hitchings & Company	8		
Huber Mfg. Co.	4		
Hydraulic Equipment Co.	80		

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